CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

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SECURITY INFORMATION

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This is UNEVALUATED Information

THE SOURCE EVALUATIONS IN THIS REPORT ARE DEFINITIVE.
THE APPRAISAL OF CONTENT IS TENTATIVE.
(FOR KEY SEE REVERSE)

DESCRIPTION OF GAS WITHDRAWAL AND TURBINE EXPERIMENTS AT THE EXPERIMENTAL AREA, GORODOMLYA ISLAND

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1. In 1947, Sector 3 was ordered to erect a small test stand (test bed) with a thrust capacity of two tons /note sketch on page 8/. The purpose was to perform tests with different mixture proportions, propellants, temperatures, injection systems, coolants, and burning times.

2. The turbine performance was to be increased /note pages 9 - 15/.

3. Sector 11 was ordered to erect the buildings for this project, but the area was ill-suited for building. Consideration had to be given to the street condition, differences in elevation, etc. Changes and conversions in design were necessary, since much of the equipment called for in the plans was not available and could not be procured. As a result, the building was not started until the summer of 1948.

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(Note: Washington Distribution Indicated By "X"; Field Distribution By "#".)

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4. With respect to the test stand equipment [see pages 18 - 21] planned in the years 1947 and 1948, the main problem was the procurement of pressure liquid containers with suitable flow indicators. Ball pressure containers which had to be mounted on scales (similar to the ones in Peenemuende and Radarach) were counted upon at first, but neither the containers nor the scales could be procured. A search of the Soviet norm catalogues for seamless drawn pipe brought about a good emergency solution of the problem of finding suitable pressure containers. After the required seamless pipe had arrived and been inspected, and the static calculations had been completed, the construction of the test stand was begun. [The construction of the pressure containers, which were actually suction chambers, will be described in detail later.] Another difficulty encountered was in the procurement of apertures. Similarly, all high-pressure valves, which were said by the Soviets to be ready and waiting in Moscow, had to be designed and constructed at Gorodomlya. The story was the same in the cases of pneumatic valves, automatic (non-return) check valves, etc. To avoid these bottlenecks, a large number of A-4 apertures were incorporated into the preliminary designs. In addition, Dr. COERMANN had to develop new pressure pick-ups for flow quantity measurement [note pages 22 - 24].

5. At the same time, Prof. BAUER issued directives to the construction department to have the test-head element, middle part, and Laval nozzle worked on simultaneously [note pages 25 - 31]. The gas withdrawal system was theoretically worked out by Dr. UMPFENBACH, Ing. POINTNER, and Dr. FERCHLAND. The main preliminary work for this system was completed in the spring and summer of 1947 in Podlipki.

6. Two compressors were received in the latter part of December 1948. By order of the director, one [redacted] transferred to another project. The result of this was that [redacted] 25X1 of intentionally delaying the work of Sector 2. Further ill-feeling was caused by the distribution of personnel. Sector 3 was understaffed for its task. Dr. UMPFENBACH took this matter up with the Soviet head, Ing. KURGANEV, who immediately transferred to Sector 3 the appropriate personnel from other sectors, especially from Sectors 1, 2, and 4. The heads of these sections interpreted this action as a personal affront [redacted] 25X1 [redacted] The rest of the Germans, however, felt that the 25X1 quarrel was mainly concerned with prospects of personal gain.

7. The tasks [redacted] from June 1947 to November 1948 were as follows: 25X1

   a. To requisition all equipment necessary for the mechanical construction of the test stand, to advise in its construction, and to make the appropriate drawings. A quick development was impossible because of the procurement difficulties. For example, if one ordered a brass pipe in January or February which was needed in

[redacted] 25X1

October, one would not receive it. In the USSR, all orders for the coming year had to be placed by December 15 at the latest. This meant that sometimes a whole year had to pass before receiving the needed material. The result was that everyone ordered much more than was actually needed, for trading purposes.

b. [redacted] 25X1

c. The next task was to set up the compressor and have it ready for operation in January 1949. Sector 11 took over the erection of the compressor building with the appropriate foundation for the compressor. On the first examination of the compressor, it was noted that the whole compressor had been dipped into hot grease before leaving the factory to keep it from rusting. Since in Sector 3, very few tools were available, and no building was available for the disassembly, I insisted that the compressor be transported to the workshop for this work. The disassembly was necessary for cleaning purposes, because it was found that all oil pipes and ducts were stopped up with grease. The cleaning and assembly of the compressor was finished in 1948. It was set up in March. The main trouble in setting it up was that the steel frame, to which the compressor and motor had to be mounted, did not fit. The compressor and motor had to be taken off the frame, the frame disconnected from its anchor, and new holes drilled into the frame in the workshop. This misfit occurred in spite of the fact that the frame, motor, and compressor were delivered from the same workshop. Actually, the difference in height of the axles of compressor and motor was 18 mm. In July 1948, the acceptance (Abnahme) was made and the first test run of the compressor was performed. From February to June 1948, the first high pressure battery (10 bottles) was set up, plumbed, and tested with 4410.0 PSI (300 atü) test pressure. At the same time, work was done on the assembly of the O_2, B-Stoff, and K-Stoff storage chamber [see pages 34 - 40].

Preliminary Work, O_2 Container

d. (1) Leakage test of the liquid container with

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water (static pressure)

(2) Insulation slots plugged with glass wool and wired up

(3) Complete degreasing of all built-in parts

(4) Paint steel containers inside with special varnish (lacquer)

(5) Pressure test at 882.0 PSI (60 atü and the steel container filled with water

e. Preliminary Work, B- and K-Stoff Containers

(1) Leakage test of the liquid container with water (static pressure)

(2) Clean all built-in parts

(3) Paint steel containers inside with varnish

(4) Pressure test at 852.6 PSI (58 atü), steel containers filled with water

f. Assembly and Testing of the O_2 Container

Great care was necessary when assembling to avoid leakage after the assembly. Each small opening in the upper part of the liquid container, relative to the overflow container, could cause leakage. After the liquid container was incorporated into the steel container and all open connections were bolted, it was again pressure tested with 147.0 PSI (10 atü). If the container did not show leakage during the test, it was released for installation. The same conditions applied to the B- and K-Stoff containers.

8. The construction of the test stand was finished in December 1948. The mechanical and electrical completion of the test stand was very difficult. An order was given to complete the test stand by February 1, 1949. (That was an order of a minister who had little technical understanding.) The Germans expected to receive the apertures from Moscow. Whether these apertures were going to be delivered according to drawings, or whether others had been readied in Moscow, nobody could tell because of the order that mountings and lead-ins be put in without the apertures. Since the measurements of the apertures were unknown, mountings and lead-ins were put in by visual observation. When the apertures finally arrived in May 1949, nothing matched. Because of an expected visit from the Armament Ministry, all the mountings and lead-ins had to be painted in different colors. (When the minister entered the test area, it was explained that everything was ready except for a few apertures which had to be mounted in between). The changes that had to be made because the measurements of the apertures were different from those originally presumed

required nearly three times the amount of time of a new laying. [redacted] 25X1

9. Transition and Adaption for Gas Withdrawal

[redacted] the turbine was to be operated by gas manufactured by injection of K-Stoff. The temperature could be controlled by varying the amount of K-Stoff injected. According to theoretical calculations, a pipe system nearly seven meters long had to be mounted to the cooling head in order to determine exactly the gas characteristics. [redacted] [redacted] theoretically, it was maintained that the gas temperature would be constant only after a long period. This theory was later proven incorrect. Further gas analyses at different concentrations were made with nearly all gas withdrawal tests. [redacted]

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10. Development of the Ignition /See pages 41 - 43./

The firing mechanism first developed by Ing. POINTNER and Dipl. Ing. KRETSCHMAR was badly designed and would probably have resulted in a loss of lives at later tests.

11. Description of the First Firing Mechanism (Zuendeinrichtung). /See pages 41 - 43./

The mechanism consisted of:

a. Acetylene pressure tank, 29.4 PSI (2 atü)

b. Oxygen bottle with conventional reducing valve

c. Butt (Handpiece)

This ignition system was only used for the first five tests, i.e., those tests made without the Laval jet. After everything was ready for the test, the butt was ignited with a match, much the same as with regular welding apparatus. From the assembly stand, it was then put through the pipe of the O_2 Head and screwed in. This method was very dangerous and complicated. Only after Ing. VIEBACH (Ing. VIEBACH was at that time given a special assignment for the ignition system for Object I) refused to use the people working [redacted] for the insertion of this in a closed system was a new method worked out. 25X1

12. Operation of the B-Stoff Level Indicator /See pages 44 - 52./

 [redacted] 25X1

The lower part of the level indicator is filled with mercury. The device operates in such a manner that the static pressure of the liquid column in the container is transferred to the level indicator. Example: As already mentioned, the blubber pressure given by the pressure reducer always has to be higher than the pressure to the liquid surface. Therefore, the blubber pressure has to overcome the static pressure of the liquid column in the container. The surmounting pressure is transferred to the level indicator and the mercury column therefore shows the pertinent liquid level. (At first the containers were measured with water and calibrated, and later the scale at the level indicator was re-figured according to the concentration.) The operation of the O_2 level indicators is, in principle, the same, only the blubber pressure is self-produced by the condensation of O_2 in the coils 76 and 77.

13. Feed Pipe System

All four feed pipes had a measuring section. The measuring section had to be as follows:

No curves
No drags to influence the flow
Larger diameter than normal feed pipe
Appropriately long input and output secti ons (Verlauf and Auslaufstrecken)
Inducer - 20D; outflow - 6D

The feed pipes of B- and K-Stoff were seamless steel pipes and were tested and used at 882.0 PSI (60 atü) after incorporation. The O_2 feed pipe was made of brass. The whole length was insulated with asbestos.

14. Results

The first gas withdrawal test was in general, satisfactory. [See pages 53 - 57.] It proved that the test procedure, in principle, was feasible. However, it was realized that a greater number of tests with this system could only be run with a very great loss of time. The main difficulty lay in the sealing of this system. Another factor was the igniting. At the beginning of the test, it could not be determined whether it had been ignited. With this long procedure, it could not even be determined whether the preliminary stage was burning or not, since (1) no flame could be seen and (2), the noise of the propellants streaming into the combustion unit sounded exactly like the burning of the preliminary stage. [redacted] 25X1 In this short time, the man at the control chokes opened them fully, since P_1 did not rise. After the combustion cut-off signal, the system was flushed with air for about ten minutes, the water pump was shut off for that length of time, the propellants refilled, and the fuse changed. Everything was all right at the new start, but the main stages were hardly switched in, and P_1 had risen to 176.4 PSI (12 atü), when the lower part of the middle part and the cooling head burned out completely along its entire length. I gave the cut-off signal immediately and extinguished the fire with water. (The water extinguisher consisted of a ring pipe with

many bores which were mounted above the combustion unit.) Immediately a large scale investigation was started to find the reason for the burning out and who might be guilty. Nothing could be established. [redacted] 25X1 After the ignition failed during the first run, and the main stages were switched in, the full flow of O_2 caused such a strong cooling action that the water was frozen in the middle part and the outlet nipple. In the second run, the water pump was running; however, the water did not go through for the above-mentioned reasons. Therefore, cooling did not take place. This caused the burning out of the middle part and the cooling head. [redacted] 25X1

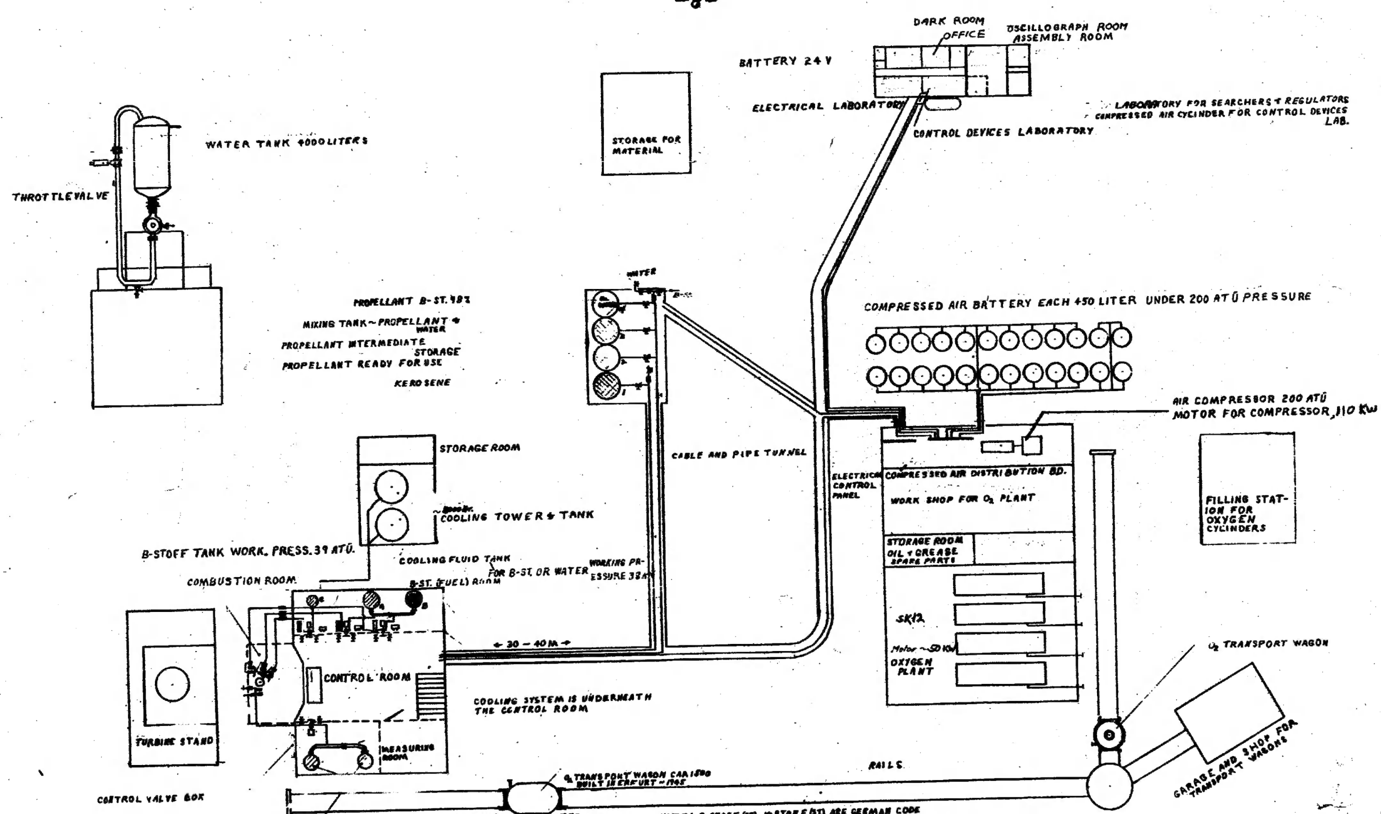
15. The worst explosion at the test stand followed next. After a new middle part and cooling head were provided, the assembly took place in the same manner. As in the previous test, the ignition failed. Due to the previous findings, [redacted] the water passages and [redacted] the pump run continuously until the starting of the next test. After about 35 minutes, all work for the new test was accomplished. There was a strong detonation when the fuse was ignited. The 180° curver and the connecting uncooled pipe flew apart and were torn into many pieces. The reason for the explosion was the collection of highly explosive gases in the pipes. The familiar word "sabotage" was hinted at more and more by the Soviets. At a discussion, Dr. FERCHLAND [redacted] recommended that the tests be run with the short system. The next day, Dr. UMPFENBACH designed a preliminary outlet curve with valve. [See pages 9 - 15.] 25X1

16. After completion of the preliminary outlet curve and the preliminary outlet valve, the starting of a test was no longer a problem. After switching off the ignition, it could be determined at the exit of the open preliminary outlet valve whether ignition had set in. If ignition had set in, sparks could be seen at the exit. After switching in of the main stage, the preliminary outlet valve was slowly closed by means of the control pressure water from container 48 [see pages 53 - 56].

17. A fast and safe development of gas withdrawal tests was insured by these changes. Hardly any changes in regard to the test results could be noted between the long and the short system under the same conditions. This was confirmed later, when tests were run with different lengths of gas withdrawal pipes. About 40 tests with gas analyses were run with this system, which was not subjected to any principal changes.

18. Gas analyses were taken while using different lengths of pipe systems. The gas was branched off right from the middle of the gas stream, [see pages 9 - 15] and diverted to containers 1-3 at different temperatures and concentrations via the valve blocks with valves 1-3.

19. [redacted] a sketch of a model plane [redacted] observed briefly during the spring of 1951 [see page 60]. 25X1 25X1


DARK ROOM
OFFICE
OSCILLOGRAPH ROOM
ASSEMBLY ROOM
BATTERY 24 V
ELECTRICAL LABORATORY
LABORATORY FOR SEARCHERS + REGULATORS
COMPRESSED AIR CYLINDER FOR CONTROL DEVICES LAB.
CONTROL DEVICES LABORATORY
STORAGE FOR MATERIAL
WATER TANK 4000 LITERS
THROTTLEVALVE
WATER
PROPELLANT B-ST.
MIXING TANK ~ PROPELLANT + WATER
PROPELLANT INTERMEDIATE STORAGE
PROPELLANT READY FOR USE
KEROSENE
COMPRESSED AIR BATTERY EACH 450 LITER UNDER 200 ATÜ PRESSURE
AIR COMPRESSOR 200 ATÜ
MOTOR FOR COMPRESSOR, 110 KW
STORAGE ROOM
COOLING TOWER + TANK
CABLE AND PIPE TUNNEL
ELECTRICAL CONTROL PANEL
COMPRESSED AIR DISTRIBUTION BD.
WORK SHOP FOR O_2 PLANT
FILLING STATION FOR OXYGEN CYLINDERS
B-STOFF TANK WORK. PRESS. 39 ATÜ.
COOLING FLUID TANK
FOR B-ST. OR WATER
WORKING PRESSURE 38
COMBUSTION ROOM
B-ST. (FUEL) ROOM
STORAGE ROOM
OIL + GREASE
SPARE PARTS
SK12
Motor ~50 KW
OXYGEN PLANT
← 30 – 40 M →
CONTROL ROOM
COOLING SYSTEM IS UNDERNEATH THE CONTROL ROOM
TURBINE STAND
MEASURING ROOM
O_2 TRANSPORT WAGON
RAILS
GARAGE AND SHOP FOR TRANSPORT WAGONS
CONTROL VALVE BOX
O_2 TRANSPORT WAGON
BUILT IN ERFURT ~ 1945
O_2 TANKS WORKING PRESSURE 38 ATÜ
~ 110 LITER
NOTE; B-STOFF (BT) K-STOFF (ST) ARE GERMAN CODE NAMES FOR PROPELLANT USED AT TEST STAND

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Withdrawal Tests

Continuation of Description of Tests and Their Results

1. Before switching over to the gas withdrawal system, two tests were run with cooling head "d" [See sketches on pages 11 - 14]. These were purely functional tests. [The assembly was the same as that shown in the sketch on page 56, except that the cooling head (Kuehlkopf) was screwed on in place of the Laval jet (Lavalduese).] The pressures on the O_2, B-, and K-Stoff main stages were αA, αB, αK, and P_i, and were measured on the oscillograph. The results of the test were unobjectionable, as had been expected.

System with Gas Withdrawal Pipes

2. The first gas withdrawal test installations were made from theoretical considerations [see sketches on pages 11 - 14]. The system contained:

   O_2 Head Element 1
   B-Stoff Head Element 2
   3/4 Middle Part 3
   K-Stoff Head Element 4
   Transition Piece 5
   90 degree Curver, cooled 6
   2 cooled pipes, each 2 meters long 7
   180 degree Curver, uncooled 8
   Short withdrawal pipe with temperature-measuring nipple, uncooled, 1 meter long 9
   45 degree Curver, uncooled, 35 cm long 10
   Jet (Duese) 40 mm
   (Entire length of pipe was about 7 meters.)

   The main difficulty in assembling was in the seal at the points where water passage sealers had to be built in. This assembly required a great deal of time. (Until December 1950 the test stand was equipped only with a K-container, and until December 1951 with only an O_2 container.)

3. In the initial test experiments, test orders were given to the experimenters just before they began the tests, i.e., the test program was discussed with all participating personnel and then accomplished. However, it was soon realized that this was impossible, and that detailed, written test orders had to be on hand. The following is a description of the first gas withdrawal test, noting all preliminary work in the mechanical field and, as far as is known, in the field of measuring technique.

TEST LOG

Test Campaign No.....
Test Order No........

Consecutive Trial No.	System: As described above	Remarks:

Test Characteristics:

Oscillograph: αA; αB; αK; P_i; TTE

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(Temperature); PTE (Pressure before nozzle) P_o: 852.6 PSI (58 atü)

Tank Pressure for B-Container) 123.4 PSI(22 atü)
Tank Pressure for K-Container) assumed 123.4 PSI(22 atü)
Tank Pressure for O_2 -Container) 368.8 PSI(24 atü)

Values to be read during test: (Not remembered by me)
Preliminary Stage injection pressures: O_2, B-Stoff, K-Stoff P_i

Main Stage injection pressures: O_2, B-Stoff, K-Stoff, P_i Pump Pressure

Preliminary Setting of Control chokes: (Assumed)- O_2-1¼ turns
B-1½ turns
K-2 turns

Quantities to be filled in:

B-Stoff - 90kg. 75% alcohol
K-Stoff - 160 kg. 75% alcohol
O_2 - 100 kg.

Quantities Tanked:
Remainder of propellants in the feeder containers after test:

Duration of burning: 70 sec.
Temperature: 400° C
Size of Shutter: B-Stoff (Depending on mixture desired)
K-Stoff " " "
O_2 " " "

Sequence of Switching Operations

O_2 - preliminary stage
Firing (ignition)
B - preliminary stage
K - " "
O_2 - main stage
B- " "
K- " "

Signatures:

Sector Leader (German) Dr. UMPFENBACH	Sector Leader (Soviet) Ing. MITSKEVICH
Test Researcher (German) Dr. FERCHLAND	Proving Ground Leader(Soviet) Ing. IOFFE
Test Stand Leader Mech (German) Ing. BRUENNER	Test Stand Leader Elec.(Ger) Dr. MAGNUS
Test Evaluation (German) Ing. PEHLE	

Preliminary Work

Pressure test gas withdrawal system at 220.5 PSI (15 atü). Fill up high pressure bottle battery 1764.0 - 2940.0 PSI(120-200 atü). Build in specified diaphragms into the B,K, and O_2 measuring tract (pressure test after incorporation). Calibrate measuring cell (Messdose), B-,K-Stoff,O_2. Test connection to the oscillograph before incorporation of

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Thermo elements; open high pressure to the test stand at the distribution board; open valve 43 /see sketch on page 18/ for control valve box; trial run of pump with water thru rate of flow. Switching of all pneumatic valves for function (after clearance signal of the measuring group). Set blubber pressure to 441.0 PSI (30 atü), fill in B-Stoff, fill in K-Stoff, fill in O_2. After completion of filling of B- and K-Stoff, and pressure applied up to the pneumatic valves, the application is done by applying pressure to the B- and K-containers (about 58.8 PSI, 4 atü), and by opening of the control chokes and opening up of the forward-pressure valves,

Commands of the Test Stand Chief:

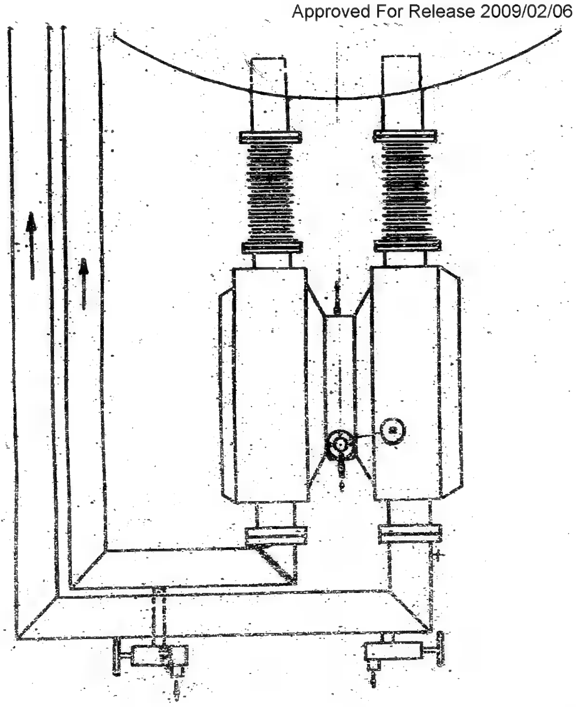
Open preliminary cooling valve I
Open preliminary cooling valve II
Tank pressures
Attention oscillograph
Switch on pump
Close preliminary cooling valve I
Flushing on
Incorporate fuse
Preliminary cooling II off
Additional inquiry whether everything is set for the test

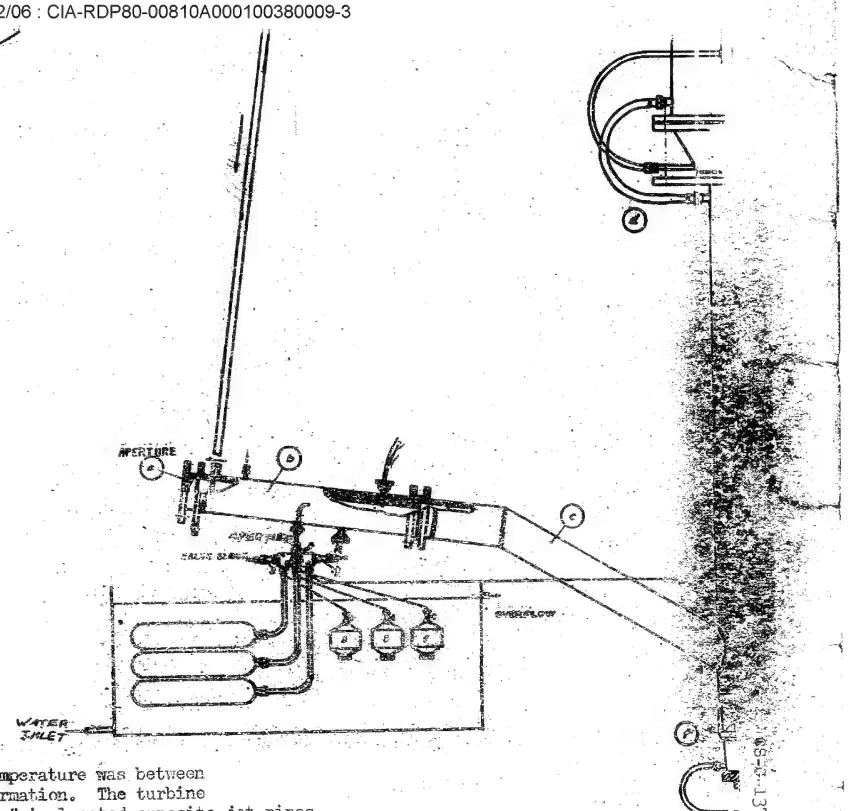
Oscillograph on (awaiting return command)
Preliminary setting of control chokes
O_2 preliminary stage

Igniting
B Preliminary stage
K Preliminary stage (waiting about 5 seconds until flame develops)

O_2 Main stage)
B Main stage) These stages have to be switched in very quick succession
K Main stage)

Combustion cut-off (at cut-off signal all pneumatic valves are closed. Flushing commences immediately).
Exhaust (entlueften) feeder containers
Cut-off pump
Close P_0
Cut-off flushing





Turbine

To increase the number of rotations, additional segments were incorporated. Result: from 4,000 to 5,500 revolutions; lifespan decreased (4 tests at most). Temperature was between 500 and 600 degrees C. according to inaccurate information. The turbine with both pumps is drawn transposed. The connection "a" is located opposite jet pipes. The distance between "a" and "b" was about 1.5 m; the distance between "d" and "e" was about 2 m. The preliminary outlet valve was controlled by water through container "g" and valve "h". Preliminary outlet valve "f" is kept under 1-2 ATO, shortly before beginning a test. Water emerges out of the bores of mushroom "i", cooling it.[1]

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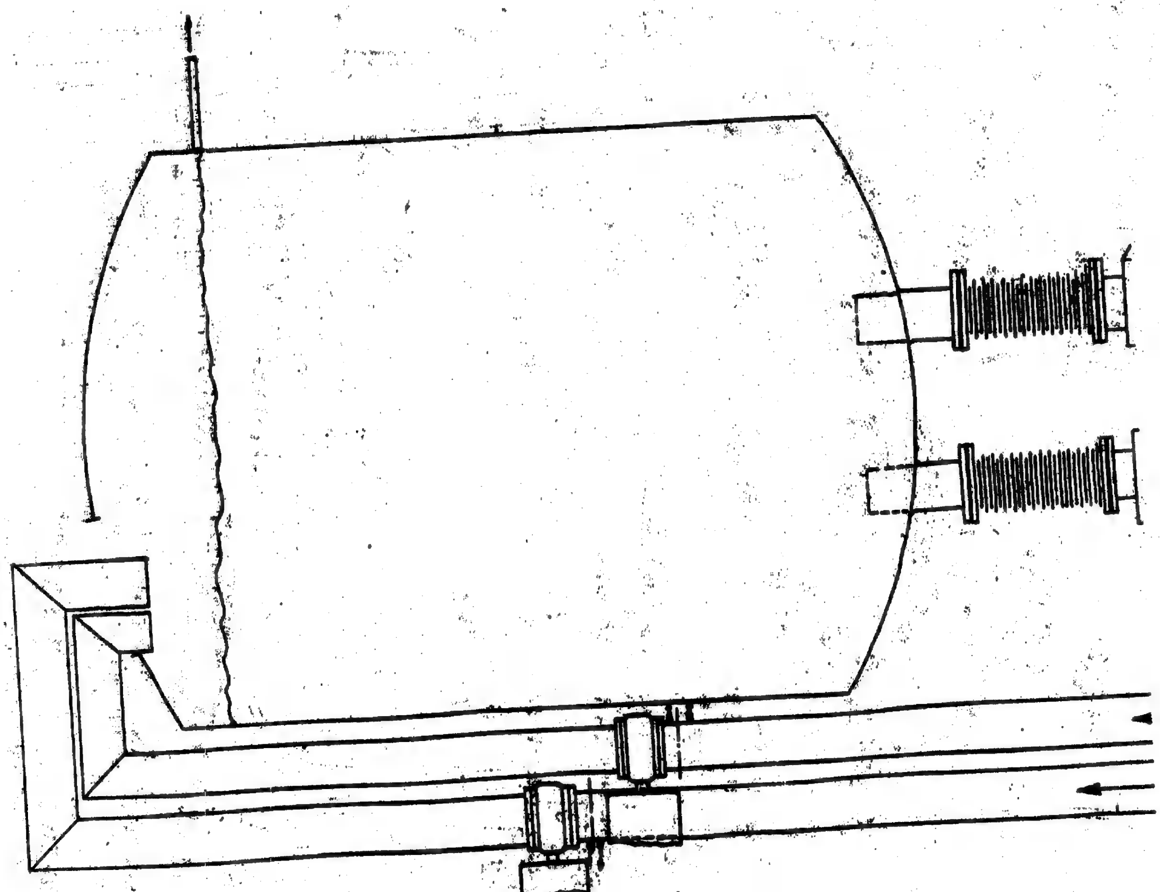
[redacted]



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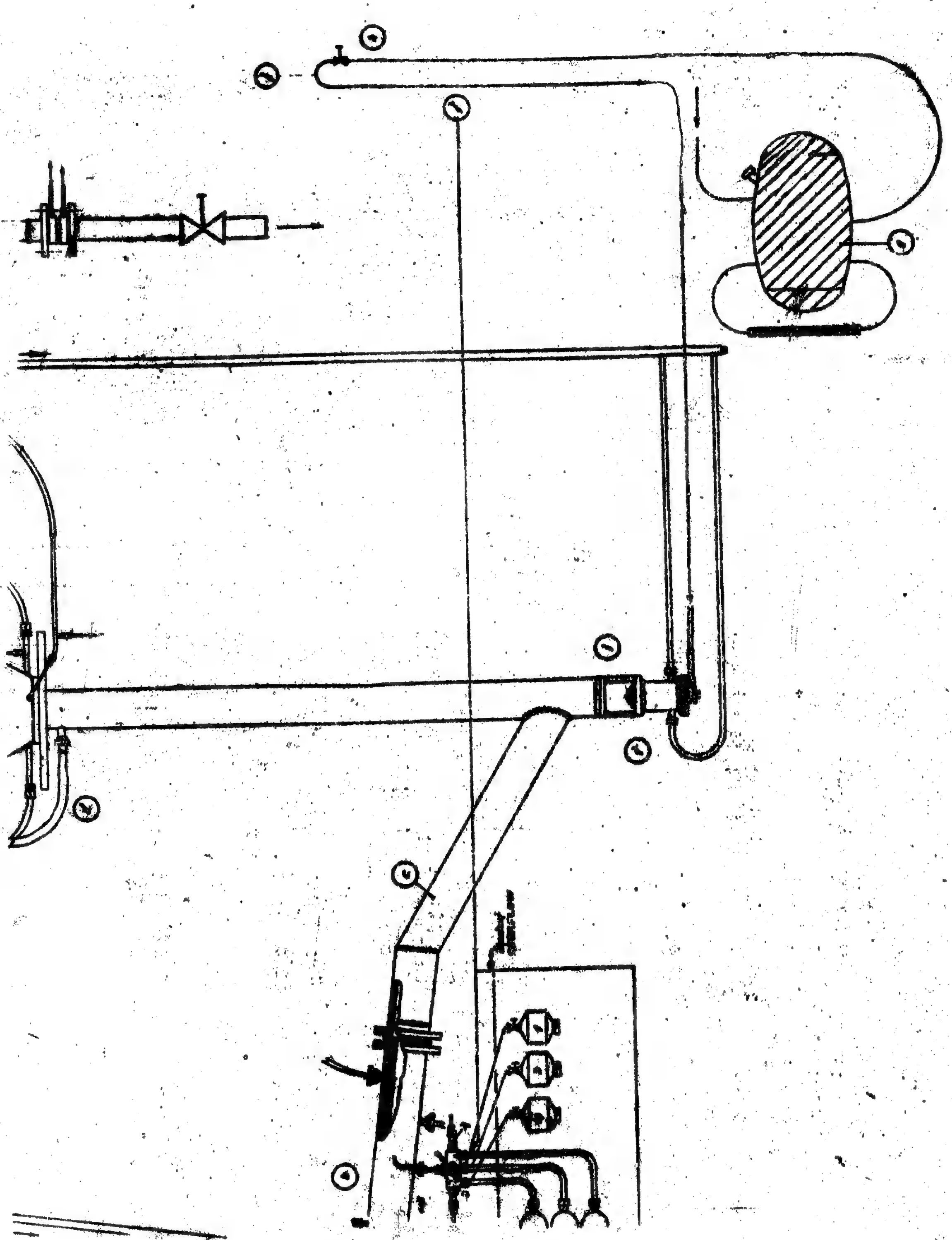

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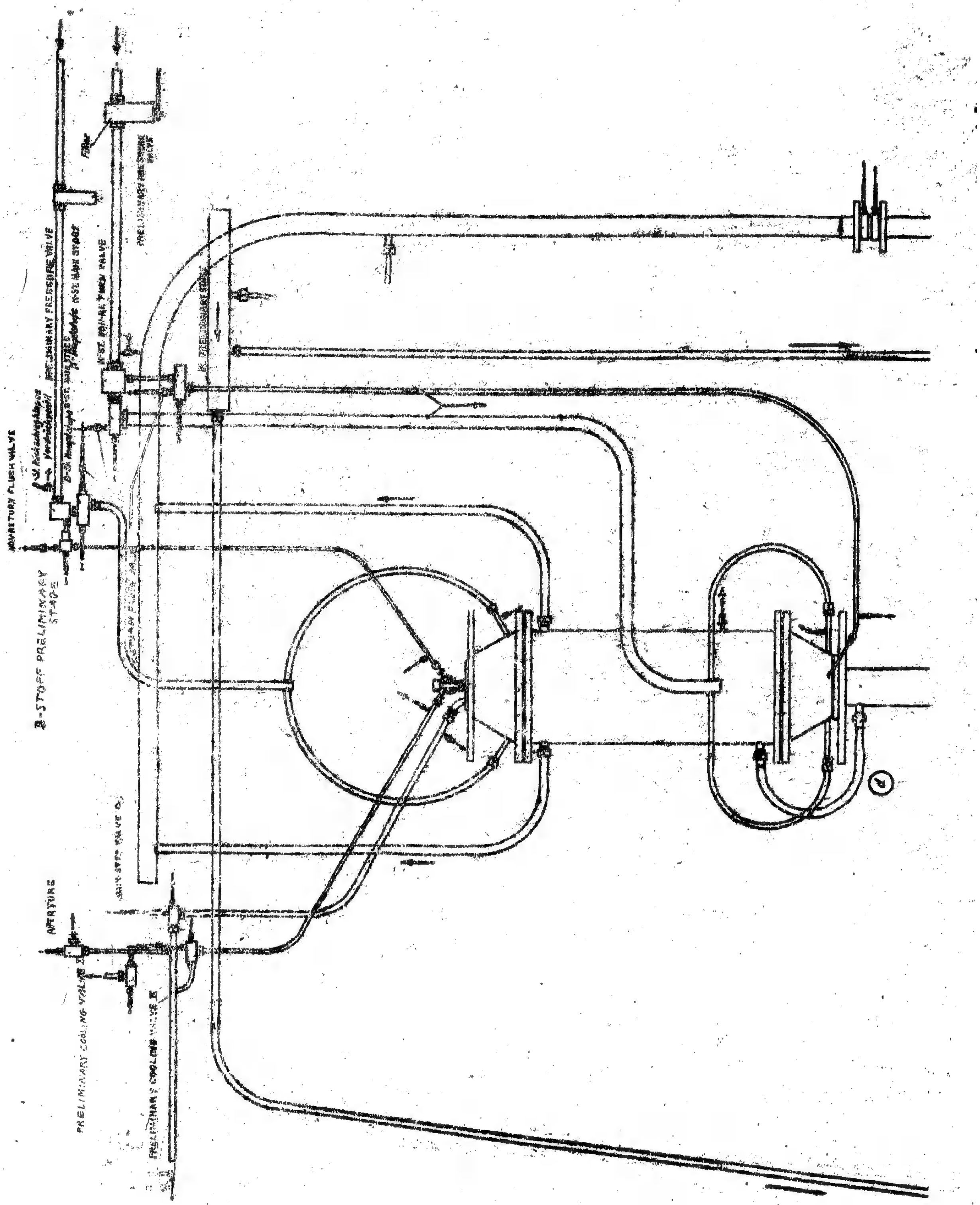
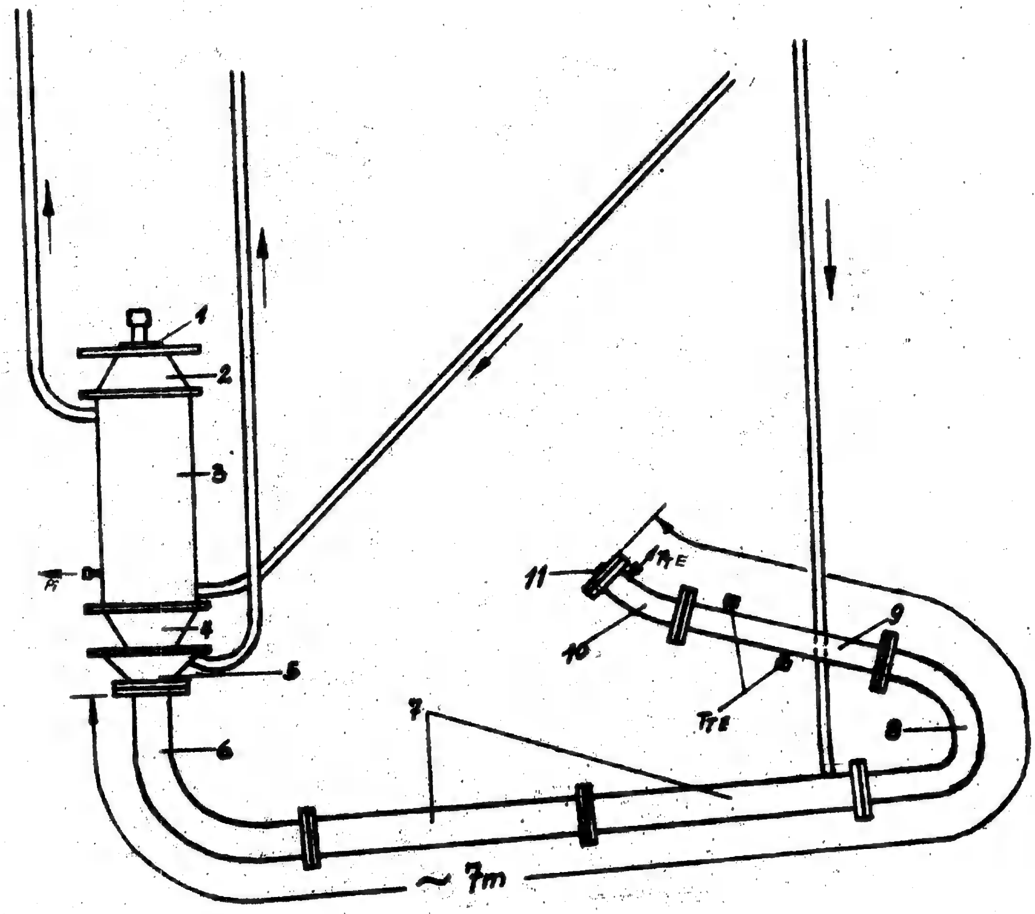

PRELIMINARY PRESSURE VALVE
3-STOFF PRELIMINARY STAGE
APERTURE
PRELIMINARY COOLING VALVE



SYSTEM WITH GAS WITHDRAWAL PIPES

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Mechanical Test Stand Equipment /See sketch on page 18./

1. Superstructure Construction:

(a) A - O_2 Container Room 2 x 2 x 6 mm.
(b) B - Measuring Chamber 2 x 2 x 4 mm.
(c) C - Battery Room 2 x 2 x 4 mm.
(d) D - Control Room 4 x 4 x 2 mm.
(e) F - Propellant Room 2 x 2 x 6 mm.

2. Color Markings:

(a) Blue - O_2

(b) Purple - Propellant (Sprit)
(c) Red - Petroleum (Kerosene)
(d) Yellow - Compressed Air
(e) Light Green - Water
(f) Green - Motor for control valve
(g) Brown - Level indicator

A - The O_2 room contains pressure controls and delivery containers 1 and 2, the air-intake valve 3, the air-outlet valve 4, control valve with motor 5, intermediate valve 6, safety valve 7, overflow valve 74, 75, two level indicators not drawn in (they are parallel connected with the indicators in the control room), the fill-in valve 8, as well as the different feed bores, which are described in detail later.

B- The measuring chamber contains all electrical devices needed at the test stand. (rectifier, voltage regulator, calibration devices, etc.). As this equipment is not well known to me, a description cannot be made.

C- This chamber serves only as dispersal room for the rectifier battery (24V).

D- The control room is the brain of the test stand. At the front end is an observation slot, drawn towards the inside, which facilitates a good view into the combustion room. Directly above the observation slot the pressure gauges, which show the pressures during the tests are mounted. Pressure gauges for:

9. - Analyses, measuring range 0 - 147 PSI (0-10 atü)

10. - Grinding pressure for vent ground control box 0-882.0 PSI (0-60 atü)

11. - O_2 Preliminary Stages- Injection pressure 0 - 882.0 PSI (0-60 atü)

12. - B " " " " " "

13. - K " " " " " "

14. - O_2 Main Stages - Injection pressure 0-882.0 PSI(0-60 atü)

15. - B " " " " " " "

16. - P_i (Combustion chamber pressure in the combustion room) measuring range 0 - 882.0 PSI (0-60 atü)

17. - K Main Stage injection pressure, Range 0-882.0 PSI (0-60 atü)

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18 - Pressure for flushing (flush valve box)

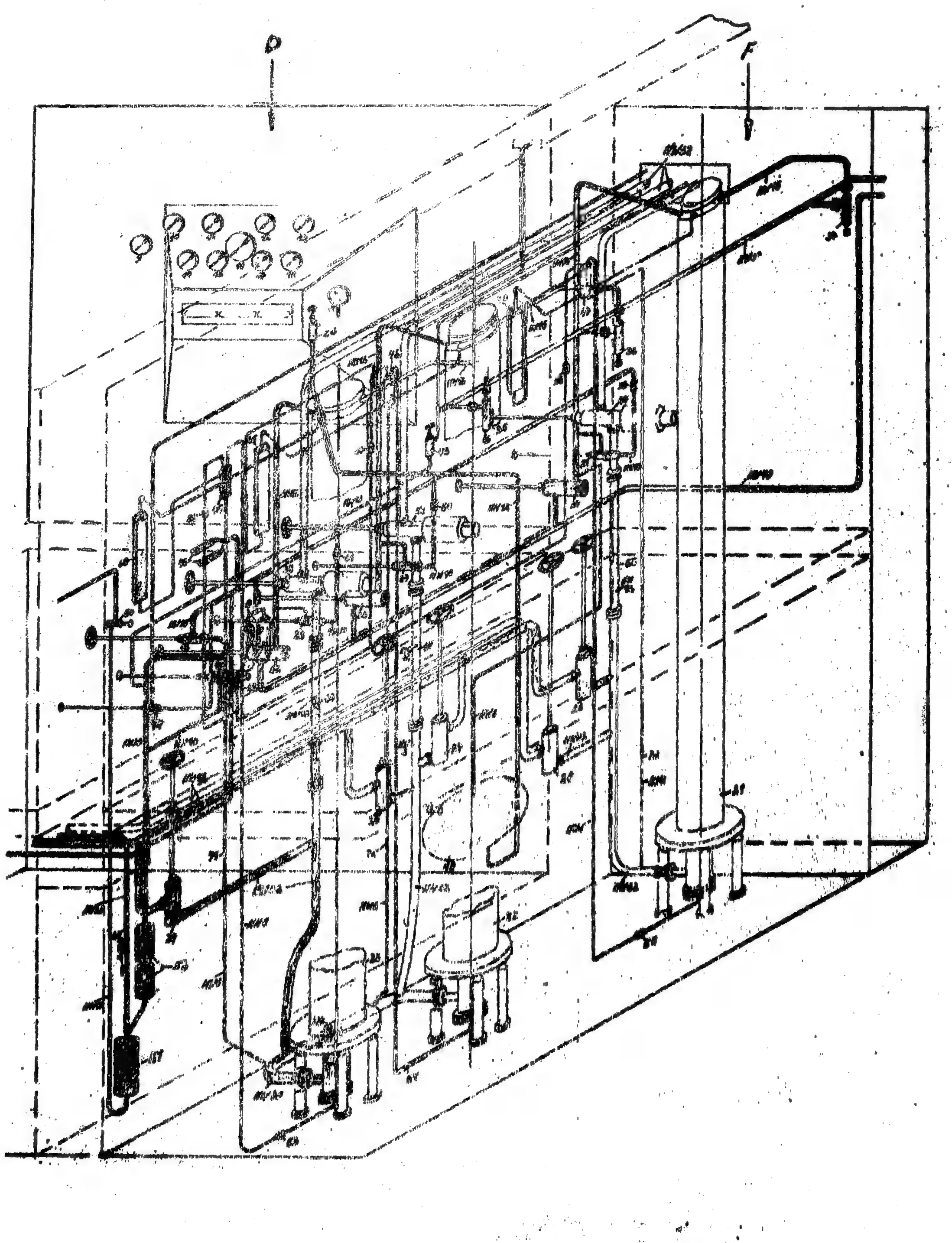
19 - Preliminary setting and closing of the pre-outlet valves

20 - Control valve. This serves as manual control valve for the preliminary outlet valve. The stems of the valves lead through the left and right walls to the the hand wheels. Above the control hand wheels, are the level indicators for the pertinent containers, as well as the pressure gauges. The arrangement of the hand wheels, manometers, and level indicators is shown [see sketch on page 20]. Directly below the observation slot is the control board. The single switches and lamps can be seen in the top view. [See sketch on page 21.]

E- The water-pump room is located below the control room.

F- The propellant room accommodates three containers, the B-container 21, K_I container 22, K_{II} container 23; [See sketch on page 36.] It contains in addition:

Filler valves 24 - 28
Air-intake valves 29 -31
Air-outlet valves 32 - 34
Safety valves 35 - 37
Control choke w. motor 38 - 40
Pressure reducer 41
Intermediate pressure valve 42
High pressure valve for control valve box 43
Flushing valve for valve box 44
Overflow containers 45 - 47
Water container 48
Intermediate pressure - safety valves 49
Water extractor valve 50
Water deflector (Wave trap) 51
Dry cartridges 52
Blubber throttles 53 - 55
Non-return check valve 56 - 62
Measuring channel 63 - 65
Pipeline systems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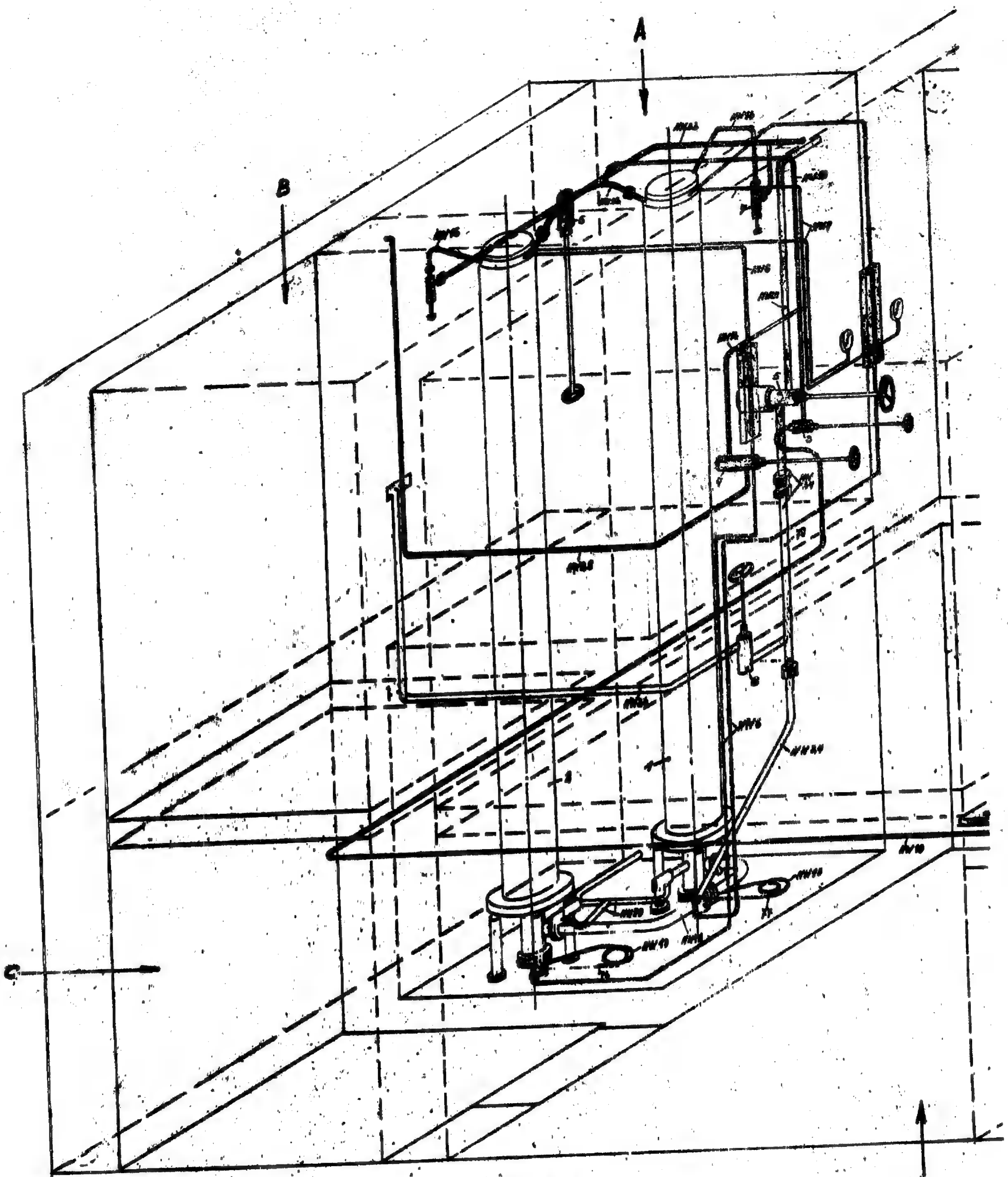

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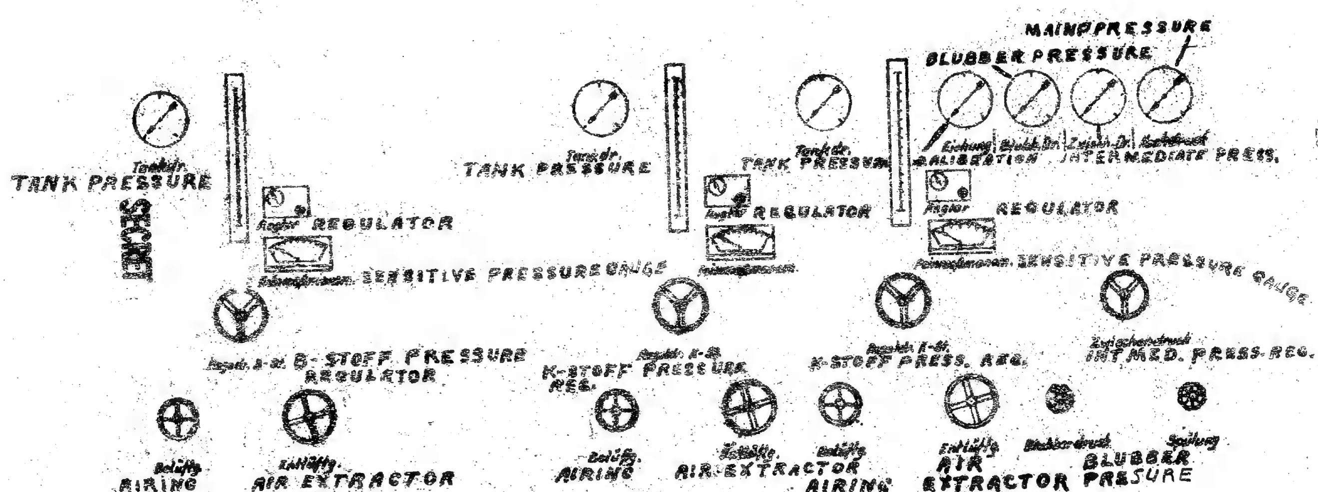
RIGHT WALL IN THE OBSERVATION ROOM



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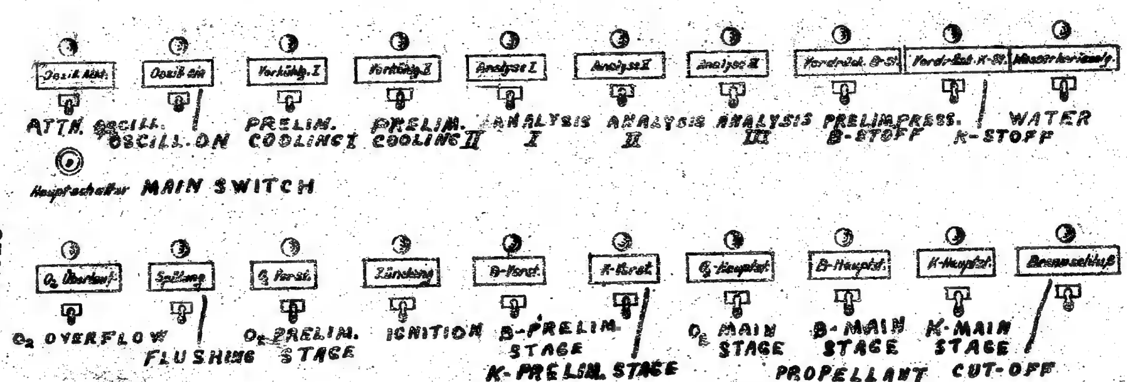
Schalteranordnung v. Schaltpult
SWITCHING ORDER DIAGRAM



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High Pressure Valve /See sketch on page 18/7

1. Description of the apertures: For compressed air up to 2940.0 PSI (200 atü), two sizes of valves were designed and constructed at Gorodomlya.

   a. High Pressure Valve Nemweite 10) Testing Pressure
   b. High Pressure Valve " 20) 4410.0 PSI(300 atü)

2. About 100 of the high pressure valves NW 10 were made /see sketch on page 23/. The high pressure valve NW 20 is similar to the NW 10 valve. The only difference lies in the larger dimensions and the flanges instead of the standard screw connections. The above high pressure valves were used on the high pressure bottle battery (Hochdruckflaschenbatterie), high pressure distribution board, at the aperture laboratory, in the oxygen equipment, and at the test stand.

3. Numbers 3, 20, 29, 30, 31, 43, 44, and 50 are high pressure valves NW 10 /see sketch on page 18/.

4. The second-largest type of manually operated closing valves was the "Nemweite" 40. These valves were designed in Gorodomlya and manufactured in Podlipki. The housing was made from Y_2A. These valves were almost exclusively incorporated into the test stand and the turbine stand. Air-outlet valves NW 40; 4, 32, 33 and 34. Filler valves NW 40: 8, 24 to 28.

5. The safety valves 7, 35, 36 and 37 also were designed at Gorodomlya and manufactured in Podlipki. The valves operated at a pressure of 558.6 PSI (38 atü), (adjustable). The safety valves 49 were screwed off the old pressure reducers of the A-4 equipment, equipped with stronger springs and adjusted to 882.0 PSI (60 atü). The control chokes were designed at Gorodomlya; the housings at Podlipki, and the stems with sleeves were manufactured at Gorodomlya. The control chokes permitted fine control and exact measuring of the rate of flow.

6. The nonreturn check valves 59 - 62 are from the steam generating plant of the A-4 equipment.

7. The pneumatic valves in the combustion room, as well as the pertinent nonreturn check valves were designed at Gorodomlya and made in Podlipki. The control valve box as well as the flushing valve box, both of which are located in the combustion room, were equipped only with magnetic control valves from the A-4 equipment. The 25+ valve of the steam plant was mainly used as a pneumatic O_2 valve and preliminary stage valves for B- and K-Stoff.

8. The chokes 53 - 55 are equipped with a diaphragm (Blende) 0.2 mm. in diameter, and are sealed with packing material (Klingerit) which passes only about three - five air bubbles per second at a pressure of 73.5 PSI (5 atü).

9. All apertures were better than those which were formerly incorporated at Peenemuende and Radarach. This could be attributed mainly to the Chief of the Laboratory, Ing. MIETH.

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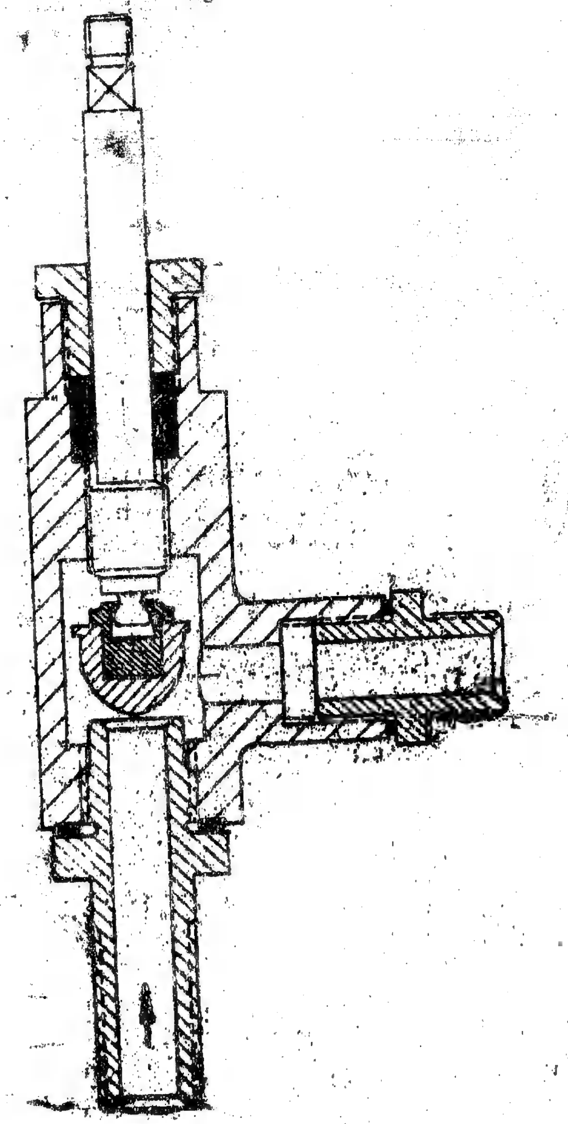

HIGH PRESSURE VALVE

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1. **Description of the** Compressed Air Piping System at the **Test Stand.**

a. The compressed air pipe 66 NW 24 aperture is connected by an outlet from the high pressure battery to the test stand via the distribution board. The discharged moisture is taken up by the water deflector 51 and drained over valve 50 from time to time. The two dry collets (Trockenpatronen) 52 clean the compressed air. The lower collet is filled with packed copper and brass shavings, while the upper collet is equipped with a filter. The filter is filled with linen discs and silica gel.

b. The high pressure builds itself up to the intermediate pressure valve 42. With this valve 42, all containers can be aired at the same time with the specified P_o pressure. (Provided exhaust valves (Entlueftungsventile) 4 and 32 - 34 are closed and air-intake valves 3 and 29 - 31 are opened). Both cushions 67 (V - 14 Ltr.) are aired at the same time that valve 42 is opened and allow easy regulation of the P_o pressure. The purpose of the nonreturn check valves 59 - 62 is to keep the O_2 container gases and the B-container and the K-container gases separate. The danger of explosion is thus avoided. It is important to set the pressure reducer 41 at 44.1- 73.5 PSI (3-5 atü) higher than the tank pressure provided for, before every airing of the B- and K-Stoff containers, respectively. If the blubber pressure (Blubberdruck) 41 is not set higher than the tank pressure, or even forgotten altogether, propellant (Brennstoff) or cooling liquid (Kuehlstoff) enters the overflow containers 45 to 47 through the chokes 53 - 55 and from there thru the pipes into the level indicators 68 to 70. This results in an incorrect level indication. The cleaning of the level indicators is difficult and requires much time. If the blubber pressure equals the tank pressure or is below it for a short while, the danger of overflowing into the level indicators is not so great. The reason is that the chokes (Drosseln) 53 - 55, do not lie under, but above the liquid level. Therefore, only very small amounts of liquid can enter, which upon entering the overflow containers 45 - 47 flow back to the containers thru pipes 71 to 73.

c. The various tanks are set at the following pressures:

Assumed -	Tank pressure - B container		352.8 PSI (24 atü)
	Tank pressure - O_2	"	382.2 PSI (26 atü)
	Tank pressure - K	"	396.9 PSI (27 atü)

A constant pressure of 808.5 PSI (55 atü) was held with the intermediate pressure valve 42, (exhaust valve closed and pressure reducer set at 426.3 PSI (29 atü). The pertinent tank pressures were regulated with the air-intake valves (Belueftungsventilen).

25X1

B-Head

1. The head element is illustrated in a cross-section /see sketch on page 26/. The turning part "a" is steel St. 55 - St. 60, and has a wall thickness of about 4 mm. The spring "b" is 4 mm. high and has a 240 mm tensility. The arrangement of the bores of the jet is symbolically illustrated in Sketch 2 on page 27. The head element has 60 jets. The jets of the A-4 combustion chamber were installed. The jets were exchanged according to flow quantity. In spite of using the smallest jets already, blind jets had to be screwed into the upper row to decrease the flow quantity. The distance between inside and outside casing "c" is 5 mm. The outside casing "e" (18 mm. thick) is welded to "a" above and below. Both the steel pipes "f" (NW 10) are welded to "e". "A" contains, distributed over its circumference, four draining bores 1.5 mm. (see "d"). The bores "d" were supposed to have prevented the following:

   a. A long after-burning at cut-off signals a transmission. (As the propellant cuts off, flushing starts immediately and presses the excess propellant out of the bores "d". (Flushing is defined as compressed air choked by a filter 2 mm.)

   b. There was an explosion at the start of the test. (After propellant cut-off and cut-off of the flushing, some excess propellant would always collect, were it not for the presence of bores "d". The flushing has to be turned on shortly before the beginning of the test. If the bores did not exist, propellant remaining down in the head element would be pressed out, atomized, and would form a highly explosive mixture. This would result in an explosion of the system at the switching on of the fuse.) The B-Stoff head proved quite useful in this manner.

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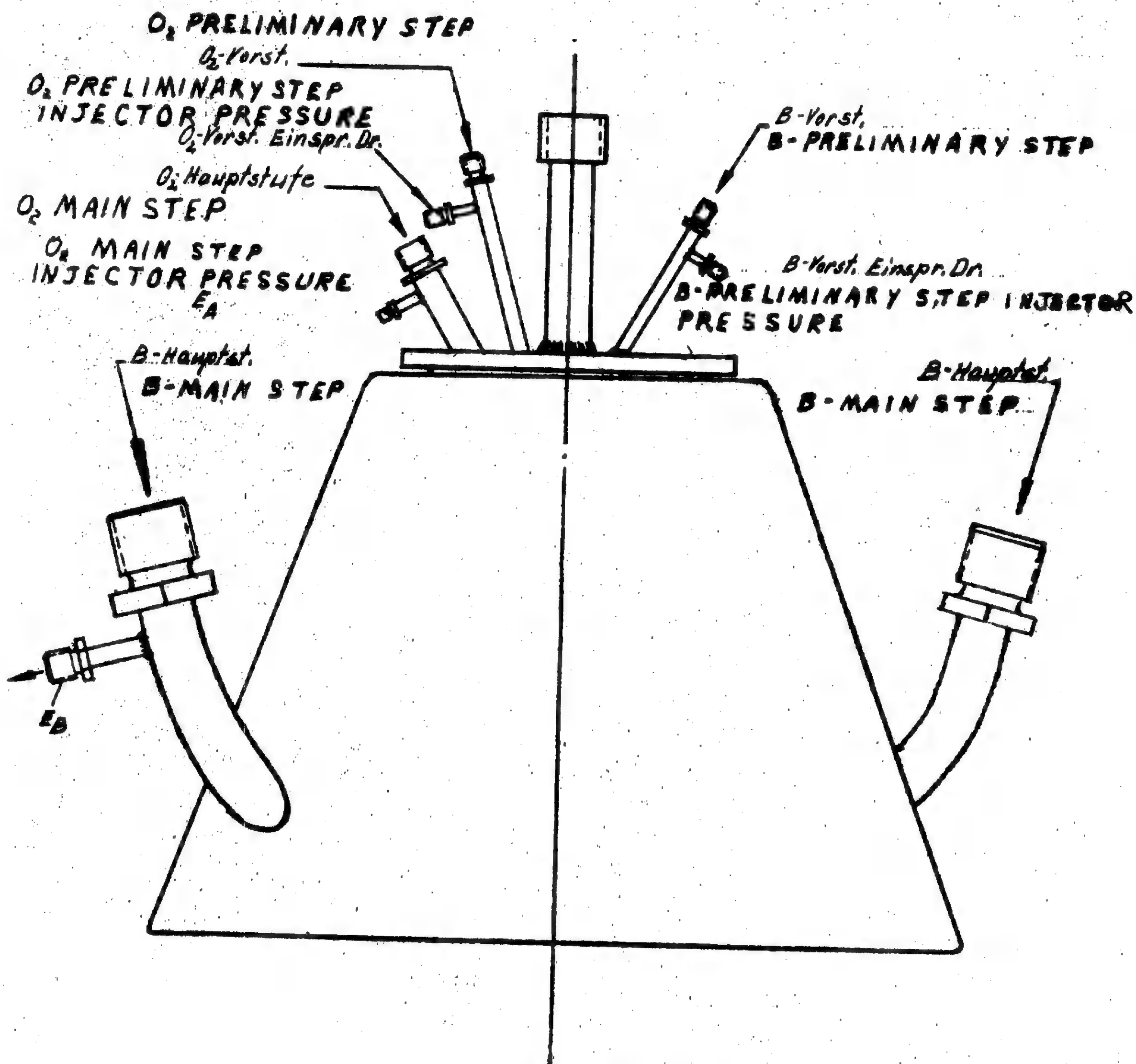

O_2-u. B-Kopf

O_2 AND B-STOFF HEAD

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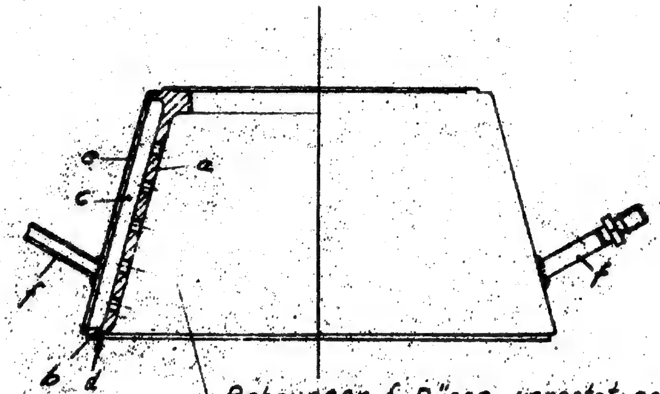
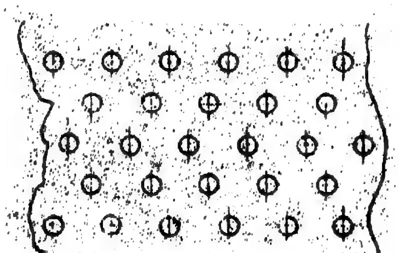


Bohrungen f. Düsen versetzt gezeichnet
CUTAWAY DRAWING OF HOLES FOR JETS



Sinnbildliche Darstellung der Bohrungen f. die Düsen
CROSS-SECTIONAL PICTURE REPRESENTATION OF HOLES FOR THE JETS

Brennkopf
COMBUSTION HEAD

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MIDDLE PART

1. As previously mentioned, three middle parts of different lengths are in existence which are water cooled [see sketch on page 29]. The middle part consists of an inside wall of 200 mm., an outer wall, and the upper and lower flanges. The material of the inner wall conforms to German St. 60 and has a thickness of 2-2.5 mm. The outer wall has a strength of St. 35 and a thickness of 1.8 mm. The space between the two walls is 3.5 -4mm. Inserted between the two walls are wires of 3mm., distributed in 100 mm. intervals over the entire circumference and electrically spot-welded to the wall. Both flanges have a sealing groove, and over the circumference equally distributed are 12 thread bores, M 14-1.5, for reception of pillar bolts. Every middle part has one filler neck and one outlet nipple, both with M 52-1.5 thread. At the lower third, it has the P_1 thread nipple M 14-1.5, NW 6. The construction of the middle part proved to be a rather good one. One hundred or more tests could be run with them.

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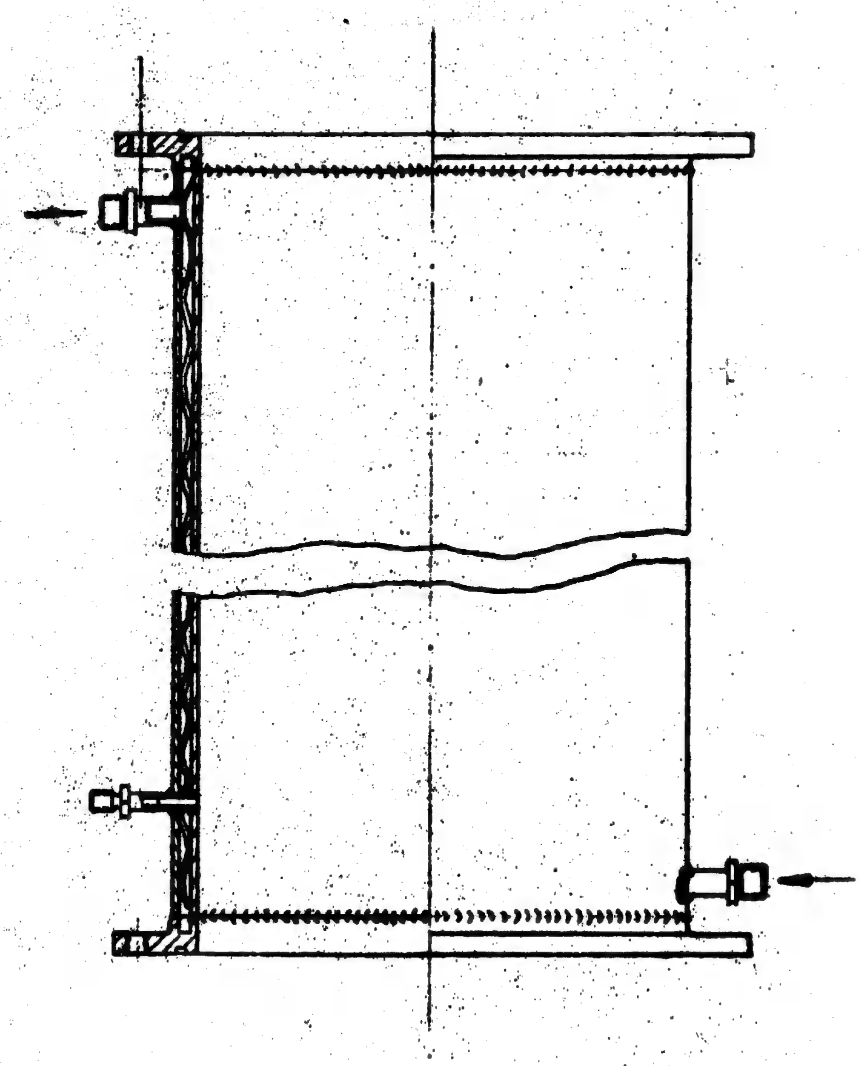

MIDDLE PART

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Laval Jet

1. The flange and the actual Laval jet are made by a lathe [see sketch on page 31]. The flange has a sealing spring 4 mm.high with 12 bores, 15 mm. in diameter, distributed evenly over the flange. The thickness of the wall of the Laval jet is 3.5 mm., and the narrowest cross section 4 mm. (Material St. 60.) The manufacture is difficult and requires considerable time. The jet is encased by sheet metal, 1.8 mm. thick, which takes on the approximate shape of the jet (nozzle). Only at the narrowest cross section, where the rate of flow is very high, is the space between jet and surrounding jacket increased. Welded to the outer jacket are two thread nipples M 52-1.5 for water intake and water drainage. At some tests, the combustion discharge pressure (Ofenaustrittsdruck) was measured, the measuring connection was located opposite the water intake nipple.

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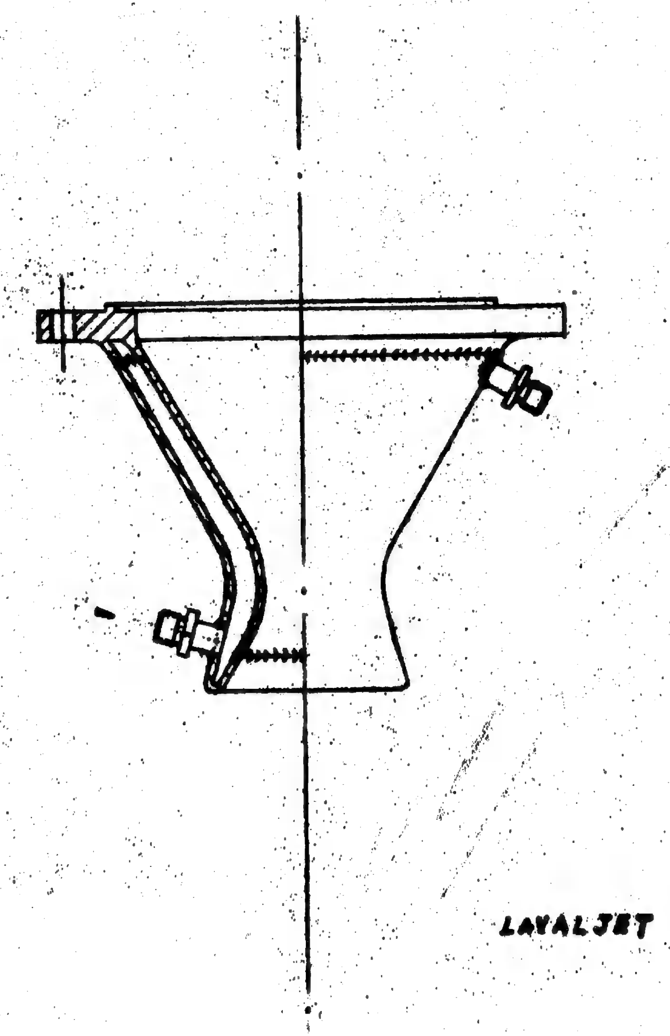

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O_2 Container with Blubber Device [See sketch on page 33.]

1. Bell
2. Pipe
3. Pipe
4. Pipe
5. Flange
6. Condensed water draining canal
7. O_2 Exit drill hole to condenser snake
8. Gas exit drill hole to the level indicator
9. Gas intake drill hole
10. Drill hole

Operation: O_2 runs through 10 between 3 and 4 through the drill hole 7 into the condenser snake. Condenser O_2 goes as gas through 9, rises into Chamber 11 and presses incoming oxygen back through drill hole 10. In this manner, the pressure of the static liquid column is surmounted. This surmounting pressure is led over 8 and into a pipe line to the level indicator.

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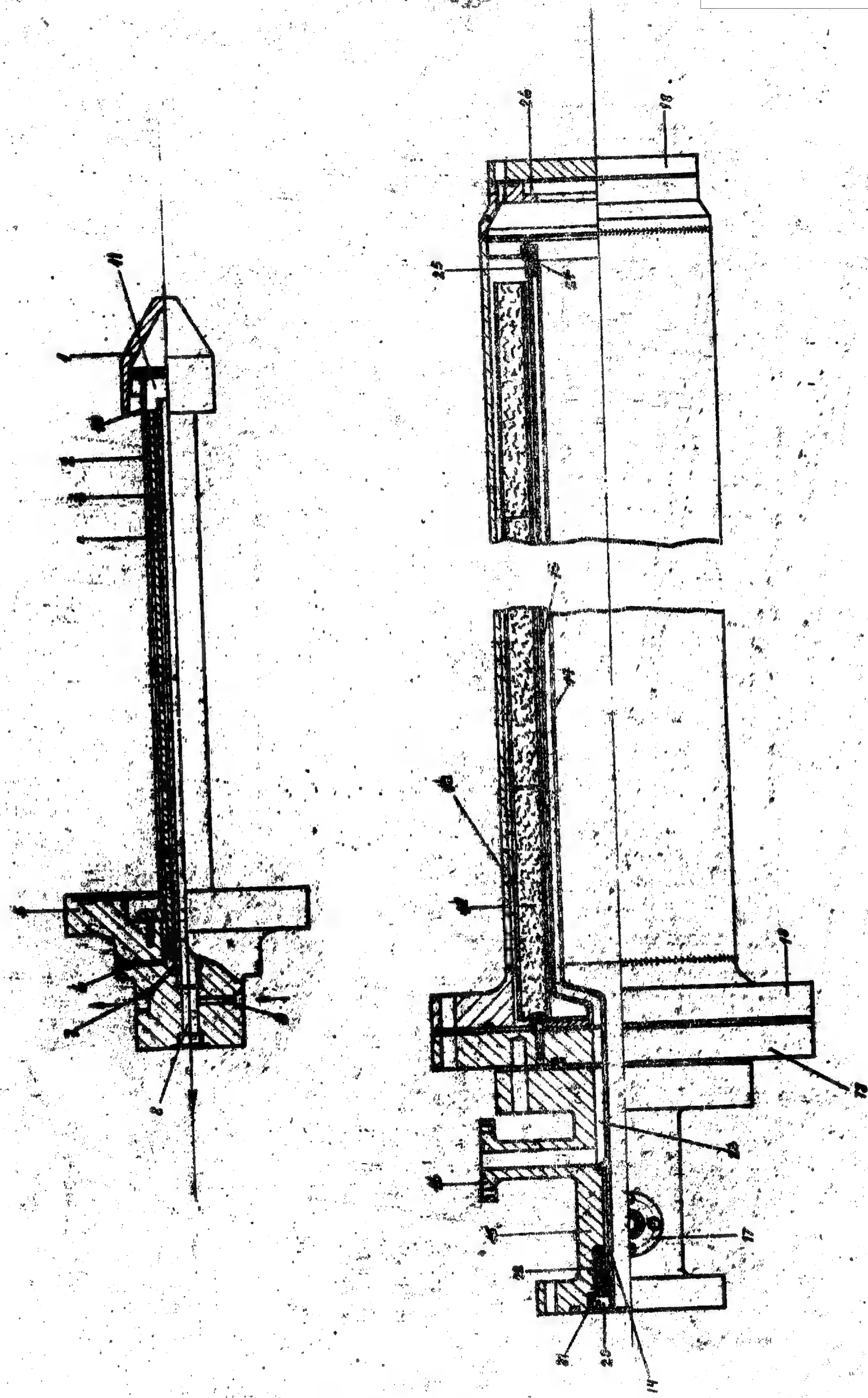

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The O_2 Chamber

1. The O_2 chamber "c" [see sketch on page 40] does not seem to conform exactly to the drawing; the chamber has probably been kept smaller. The feed pipe of the O_2 and B-Stoff preliminary stages are copper pipes, 4.6 mm. The feed pipe of the O_2 main stage is a steel pipe 10.14 mm. the size of the thread was 100.1.5. This O_2 head was sufficient for the requirement.

25X1

B-Stoff and K-Stoff Containers

The B-Stoff and K-Stoff containers differ only in their diameters; their lengths are the same. /Note sketch on page 36./

B-Stoff container: V = 110 liter water

K_I and K_{II} containers: each V = 240 liter water

1. Steel flange
2. Reception for searching flange
3. Container head (the following passages: level indicator and at the same time manometer; ventilator; exit to safety valve)2
4. Steel container
5. Liquid container (of aluminum)
6. Blubber button
7. Blubber pipe
8. Blubber union
9. Blubber receiving pipe
10. Overflow - drain
11. Connection flange for feed line
12. Drill hole for blubber pressure

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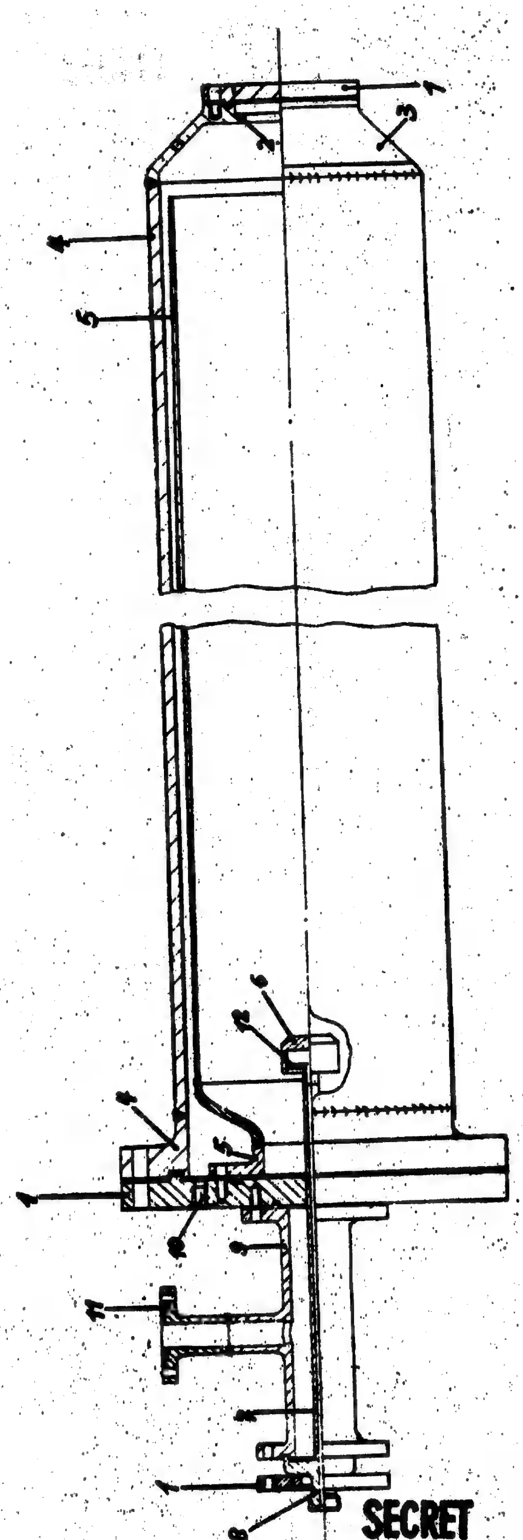

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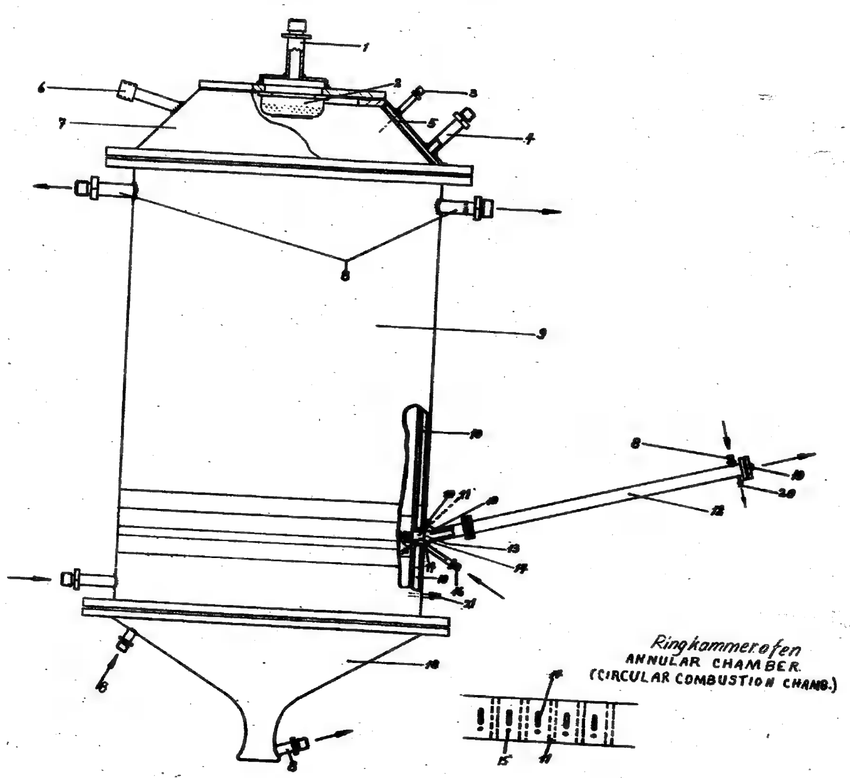
Circular Combustion Chamber (Ringkammerofen) /See Sketch/

1. O_2 Main stage
2. O_2 Diffusor
3. B-Stoff preliminary stage
4. B-Stoff main stage
5. B-Stoff nozzles (A-4 nozzles) (Duesen)
6. Pipe for ignition point (Zuendeinsatz)
7. B-Stoff head element
8. Water outlet fitting and inlet fitting
9. Chamber middle part
10. Passage for cooling water
11. Passage holes for cool water
12. Nozzle pipe
13. Gas withdrawal ring
14. Gas exit slot
15. K-Stoff nozzle holes
16. K-Stoff main stage
17. K-Stoff ring canal
18. Laval nozzle 28 mm.
19. Gas nozzle 28 mm.
20. Fitting for P_{TE}
21. Fitting for P_1

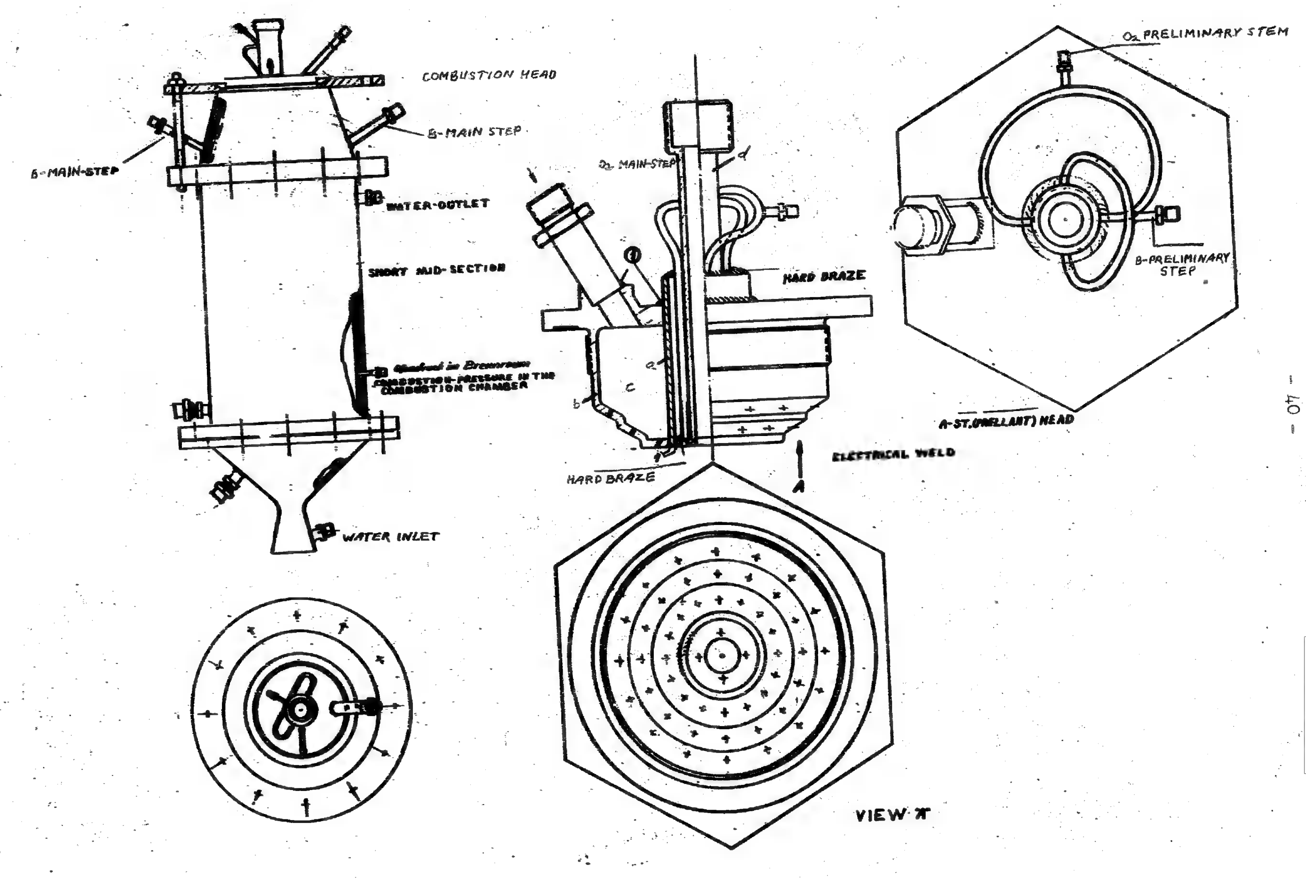


SYMBOLIC PRESENTATION OF THE COMBUSTION CHAMBER VIEWED FROM INSIDE

25X1

Combustion Head [See sketch on page 40 and pages 53 - 56.]

O_2 Head [sketched on page 40] shows a cross-section of the O_2 head. The head shown does not differ principally from the ones burned on Gorodomlya. The dividing pipe "a" prevents direct contact of O_2 with the B-preliminary stage pipe running through the head. (B-Stoff freezes at 42°C.) On the other hand, a premature condensation of O_2 is also prevented. In the middle of the head is the pipe for reception of the ignition 60, and has the characteristic of increasing its hardness in cooling to about 80°C. If the material cools even more, hardness remains the same, but it becomes very brittle. Wall thickness "b" is 3 ± 0.5 mm.



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Ignition Segment

1. The second solution to the ignition system is shown [see sketch on page 42]. The ignition cartridge "a" is surrounded by copper tubing "k" 10.12 mm. and has a length of 120 mm. The upper end of the tubing is sealed by cardboard cap "b". Into the middle of cap "b" is pressed contact pin "c". The middle of the pin "c" contains a bore into which a two-strand copper wire is soldered. The copper wire leads to the lower end of the cartridge in the middle of the legalized powder. The wire is single-stranded from the middle "d" to the soldering point "e" so that when short circuited, the wire burns through at this point and ignites the powder. A thin paper with a wax layer is put over the lower end to prevent exposure to moisture. The ignition point consists of:

   a. m - locking screw
   b. f - spark plug
   c. g - reception head
   d. h - rubber sealer
   e. a - ignition cartridge

   Pipe "i" is part of the O_2 head element. [This is marked "d" on sketch on page 40.] More than 200 tests were run with this ignition point. At least 30 per cent ignition failures were registered. Explosions occurred which often damaged the O_2 head considerably. In the spring of 1951, eight consecutive igniting failures were registered. After this, [redacted] given the order to construct a new ignition point. However, no changes were to be made on the O_2 head element. 25X1

2. The sketch on page 43 shows the new ignition point, which seldom registered a failure. Most of the failures of the ignition point [see sketch on page 42]. occurred where the cartridges did not ignite at all, or exploded. I presumed that the former type of failure was caused by the contact breaking between pins "c" and "l" upon insertion of the ignition point into the A-head. The latter failures were probably caused by the wire leading through the center moving during filling and making contact with pipe "k". This causes a short circuit before the ignition point, which results in an explosion.

   a. Description of ignition point [see sketch on page 43] follows. Cartridge "a" is filled with legalized powder. Legalized powder is a large, slate-like black powder, unknown composition. The casing "b" and lid "c" are cardboard and two insulated cables "d" and "e" lead through the cartridge. The two cables are connected at the lower end by a thin wire, which melts at the start of ignition and ignites the powder. Contact pins "g" and "h" lead through a hard rubber disc "f". Locking screw "k" pushes hard rubber disc "f" against pipe "i". Leakage of gases is prevented by sealer "l". To prevent spilling of powder out of casing "b", as well as penetration of moisture into the powder, a thin paper is pasted on from the lower side as closure. The burning time of the cartridge sketched on pages 42 and 43 is seven to ten seconds.

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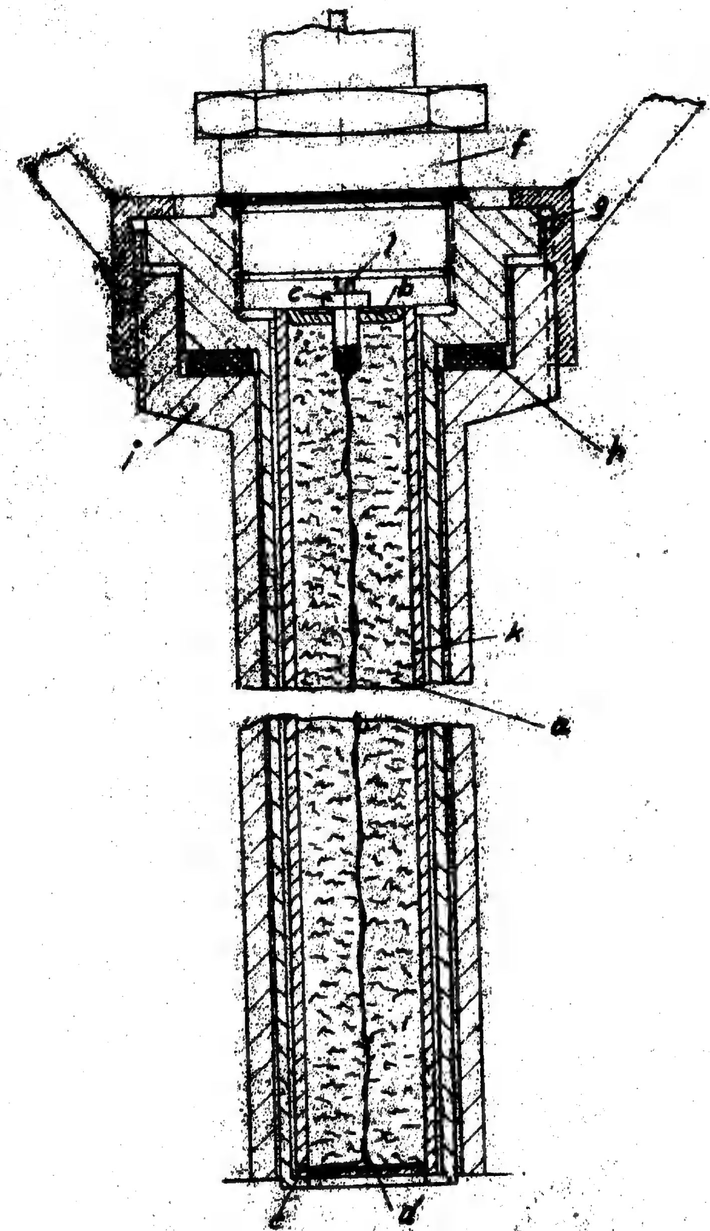

IGNITION SEGMENT

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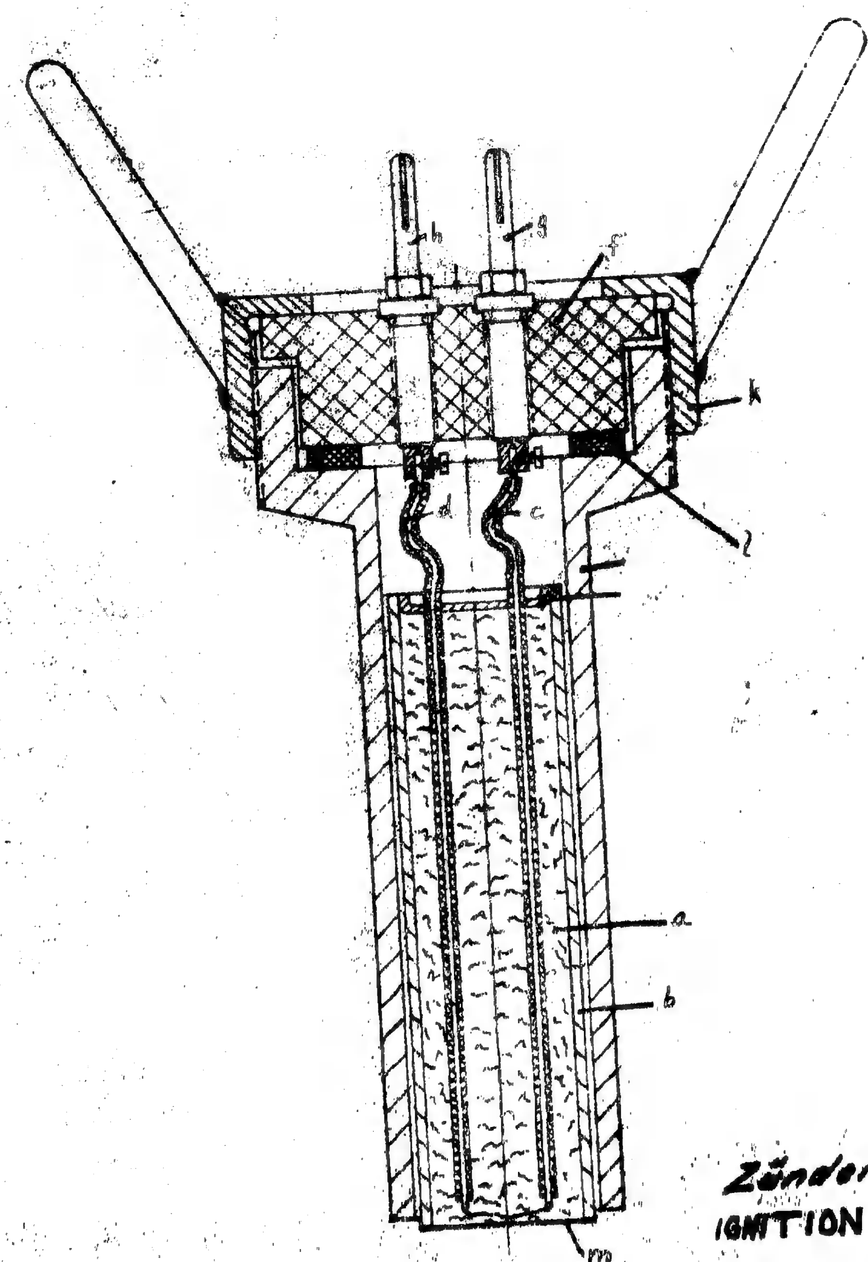

Zündeinsatz
IGNITION SEGMENT

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Turbine Test and Test Stand

1. Turbine Tests. The turbine stand was erected in the spring of 1950 and afterwards, tests were run with the regular A-4 turbine. The purpose of these tests was; Testing of the turbine with the gas withdrawal system at different

   Temperatures
   Concentrations
   Apertures in the feeder pipes of the pump pressure sides.

2. Set-up of the Turbine Test. (See test log following.) It is to be noted that when testing the turbine a choke NW 40 was incorporated between preliminary outlet curver "c" and the jet pipe "b", which was opened after the main stages, and came in without trouble. (The choke has a rotating plate which can be opened or closed from the outside by turning on the longitudinal axis by a motor.)

Test Log for Turbine Test

Test Campaign No....
Test Order No.......

Consecutive Test No.	System	Remarks
	O_2-Head; B-Head; 3/4 Middle Part; K-Head; Transition Piece; Prel. Outlet -T-Piece (preliminary outlet curver); Preliminiary outlet valve, jet pipe; Connection pipe to the turbine, 50 mm. in diameter; A-4 turbine	

Course of Test:

Oscillograph: q_A; q_B; q_K; P_i; T_{TE}
(Temperature shortly before turbine) P_{TE}
(Pressure in turbine) Revolution counter
P_o = 352.8 PSI (24 atu) (Pressure is kept constant in all containers by intermediate pressure)
Values to be read: Preliminary stage injection pressures, as well as main stage injection pressures of O_2, B-Stoff, K-Stoff; number of revolutions of the turbine; water pump pressures of the A-4 turbine; cooling water pump pressure; P_i
Preliminary setting of the control chokes: O_2, B- and K- Stoff
Quantity to be filled: B-Stoff 75%, 100 kg.
Quantity to be filled: O_2 100 kg.
Quantity to be filled: K-Stoff 75%, 100 kg.

Filled amount of propellant before test: O_2; B-Stoff; K-Stoff

Remainder of propellant in the feed containers after test: (This was read after the completion of the test.)

Size of apertures: O_2; B-Stoff, K-Stoff, pumps (turbine stand), cooling water

Temperatures: 350° ; 400°

 25X1

Sequence of switching in:

Ignition; O_2 Preliminary Stage; B-Preliminary Stage; K-Preliminary Stage; O_2 Main Stage; B-Main Stage; K-Main Stage

Open choke; close preliminary outlet valve slowly.

Signatures:

Sector Leader (German)
Dr. UMPFENBACH

Sector Leader (Soviet)
Ing. MITSKEVICH

Test Researcher (German)
Dr. FERCHLAND

Proving Ground Leader
(Soviet) Ing. IOFFE

Test Stand Leader Mech.
(German) Ing. BRUENNER

Test Stand Leader Elec.
(German) Dr. MAGNUS

Test Evaluation (German)
Ing. PEHLE

Result: The computed values agreed with previous data of the A-4 turbine. After two more tests, the turbine was disassembled and tested. The condition was excellent. (Speed of the turbine was approximately 4,000 rpm.) To complete the turbine discussion, I have described the analyses test development later. The trend was toward changing the turbine without great expenditure and to increase the speed and thereby increase the performance.

<u>The first change:</u> Two closed segments were made from the A-4 and incorporated. The result was that speed was increased to about 5,500 revolutions pm. However, the turbine could not be used that way, since considerable damage was found after every test, due to distortion of the two long segments. Damage also was done to the reversing stator blades and the impeller.

<u>Second change:</u> Four segments, but the same number of reversing stator blades as with the two segments were used. The gap for expansion was 1 mm. This version was satisfactory, (revolutions between 4,000 and 6,000 rpm, probably more than 8,500 revolutions at one test, but the revolution counter failed). The turbine tests were continued in this set-up, but with increased temperatures. The temperatures at that time ran to a maximum of 450°C, to the best of my knowledge. All tests with increased temperatures ran into considerable difficulties. At increased temperatures, the following faults occurred:

Distortion of the reversing blades
Distortion of the segments
Distortion of the whole segments

This required the disassembly and repair of the turbine after each test. To avoid distortions, a strong steel retainer was constructed. (Called catastrophe retainer.) Many important people believed this to be an improvement. At further tests the segments, reversing blades, and even the rotor melted through. A discussion with Dr. UMPFENBACH verified 25X1 that the peak efficiency of the turbine was reached and that its efficiency could not be increased any further, 25X1

 25X1

i.e., for tests with a maximum temperature of 450°C and a maximum number of 6,000 revolutions pm. Further developments might have been possible with different materials. Further tests were run after changing Number 2 to ... kerosene. (Kerosene was used as a propellant, as well as a cooling agent.) The kerosene anaylsis tests will be described later. Two changed and competent turbines were shipped to Kapustinyar in the spring of 1951. Their further use is unknown.

Changes at the Test Stand

1. Incorporation of regulators developed by Dr. MAGNUS and proven competent, in the summer of 1950. 25X1 25X1

2. One regulator was incorporated for each propellant container, O_2,B- and K-Stoff, and cooling agent container.

3. The regulators were adjusted to each other and assured exact mixing proportions during the test, as well as the set temperature.

4. The following is known:

   a. For each measuring tract, O_2, B-Stoff and K-Stoff, a large number of calibrated apertures existed.

   b. The control chokes [see sketch on page 18] can be regulated manually or by motor.

1. A test with electrical regulation was prepared and run as follows:

   a. Preparations: Calibration of measuring cell (Messdose). Three values were read and written down at this calibration.

      (1) Mercury column 0-140 kg. (calibrated upward and downward).

      (2) Scale parts of the sensitive pressure gauge.

      (3) Values were written down in the oscillograph as well.

   b. After calibration of the pressure measuring gauges of O_2, B-, and K-St., aperture sizes and pertinent amplification stages were made known according to tables, and noted on the test order. On the basis of the calibration values received and the defined aperture sizes, the preliminary settings of the control chokes were marked in the test order, e.g., a combustion pressure of 264.6 PSI (18 atü). Also, the scale mark of the sensitive measuring gauges for the regulators, to be regulated at the starting of the test, was calculated and marked down in the test order.

2. As already mentioned in previous descriptions of the tests, at the command "Preliminary setting", the control chokes were manually opened to the specified number of turns. (There also existed a preliminary setting for the slide, which was moved by motor. The preliminary setting is set in degrees

which were marked in the test order.) After switching in the main stages, the control chokes were opened slowly by hand until the needles of the sensitive measuring gauges reached the specified scale mark and the manometer reached the computed combustion unit pressure. Only then were the electric regulators switched on.

3. The regulators were set for the P_1 pressure. From that, rate of flow and mixing proportions, as well as temperature, were determined electrically. The regulators were very exact. If several temperatures were run at the same test, a temperature change could be made at the K-Stoff regulator during the test. Temperature changes affect the combustion unit pressure, which was automatically corrected by the O_2 and B-Stoff; regulators which increase or decrease the rate of flow, so that P_1 returns to the present value.

4. A second O_2 container was installed in December of 1950 and a second K-St. container was installed in February 1951. These installations were necessary to conduct the test of the annular combustion chamber (Ringkammerofen). The reason for this was that combustion chamber pressure was 352.8 PSI (24 atü), therefore causing a higher consumption of propellants. Both K-St. containers were connected by a larger pipe, NW 70. The containers could be emptied together through measuring tract 63 or 64. The containers could be separated by insertion of a blind aperture. The same goes for the airing, which, however, is not taken into consideration in Schematic 1. The connection of the two O_2 containers is similar. The airing is not separated by an aperture, but can be disconnected by closing of valve 6.

5. Water pump with double the capacity was installed. Almost 200 tests were run till February 1951. Most tests were termed "Gas-examination". The kerosene tests were started the first part of February 1951. Lack of time prevented me from going into this test procedure. (The kerosene tests were run with the same system as already described.)

6. The next test was the demonstration of gas withdrawal with the Laval jet, (Lavalduese). /See pages 37 and 38./ The circular combustion chamber was equipped with a ring in the lower third of the combustion chamber through which K-St. was injected and gas withdrawn. Besides, the ring had longitudinal cooling bores, through which the cooling water passed. The combustion unit had a Laval jet 28 mm in size (Lavalduese). The gas withdrawal pipe with nozzle was screwed to the ring mentioned above. The head element was flat and wide and had fewer, but larger, propellant jet nozzles. (Brennstoffduesen). Two O_2 head elements were tested. The first head was constructed in such a manner that three injection discs, constructed for the head, could be exchanged. The discs were flat and their bores had different clearance angles. (Anstellwinkel). The second head was, in principle, the same as illustrated /see sketch on page 40/. The new head differed only in that the bores were larger and therefore, the O_2 preliminary stage was eliminated. A special thrust mechanism was constructed for this combustion unit. (Parallelogram with thrust measuring traverse and calibration mechanism.) The thrust measuring traverse was developed by

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Dr. COERMANN. The accuracy of measurement was ± 0.5 kg. The tests with injection discs did not prove successful, so the O_2 atomizer (A-4 atomizer in principle) was retained. /See pages 58 and 59./

7. Tests with the circular combustion chamber were run with the following concentrations. (The number of tests with different concentrations, as well as their results, cannot be stated.) All tests were run with O_2, but B- and K-St. changed constantly.

No. of Tests	%B-Stoff	%K-Stoff
4	75	75
2	75	96.5
2	75	60
2	75	40
2	75	25
2	75	Water
3	96.5	96.5
2	96.5	75
2	96.5	60
2	96.5	40
2	96.5	25
2	96.5	Water
10	Kerosene	Kerosene
2	Kerosene	75
2	Kerosene	Water
4	75	Kerosene

(A similar test campaign was run previously with the gas withdrawal system) The following measurements were taken at the circular combustion unit:

Oscillograph: q_A; q_B; q_K; P_i ; T_{te}; P_{te} tank pressures.

During the test, the following were written down by hand:

E_A; E_B; E_K; P_i; P_{te}; tank pressures

Still known are the tank pressures: O_2 container 514.5 PSI(35 atü)
B- container 499.8 PSI(34 atü)
K- container 499.8 PSI(34 atü)

P_i (at all tests) 352.8 PSI (24 atü)

Gas analyses were taken at some of the tests in this campaign.

8. In all tests run up to June 1951, the measurement of consumption was not exact enough, especially of q_A. This was the reason for the development of feeler probes (Sonden). /See sketches on pages 50 and 51./ The fuel containers were especially suitable. The liquid container in the O_2 container had only one measurement of 170 mm and one length of 5000 mm. Two types of feeler probes were developed. The first development /see page 50. / with eight ball floats was complicated to produce and did not always function. The second type /see page 51/ required a lot of time and headaches in the construction of the float, but was produced with less complication and functioned

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well. After installation of the feeler probes and completion of the test campaign with the circular combustion chamber, it was changed over to the gas withdrawal system and tests were run with very high temperatures. The purpose of those tests was to get analyses at very high temperatures. The main difficulty here was in the procurement of materials for the thermo elements. In six tests at least, the thermo elements, including the radition protectors, burned through. It was intended to run tests up to 1,300 C. As this proved hopeless, it was satisfactory to get anaylses up to 1,200 C.

9. After the German experts left the test area in December 1952, this series of tests was continued by the Soviets. To receive even better analyses, a new analytic device, developed by Germans, was installed after the German separation from the experimental station. The difference between the old and new device was that the new one was equipped with a cooling system. The valve block /see sketch on page 11/, the valves, and the pipe above and below the valve block were equipped with a casing, through which cooling water flowed during the test. This change was for the purpose of chilling the gas withdrawal from jet pipe "b".

10. Flame and steam patterns formed during the tests. The first tests with the Laval jet (Lavalduese) showed a formation of standing waves almost equally spaced. At a combustion chamber pressure of 264.6 PSI (18 atü), six standing waves showed. The first four standing waves were clearly visible, while the last two were somewhat blurred.

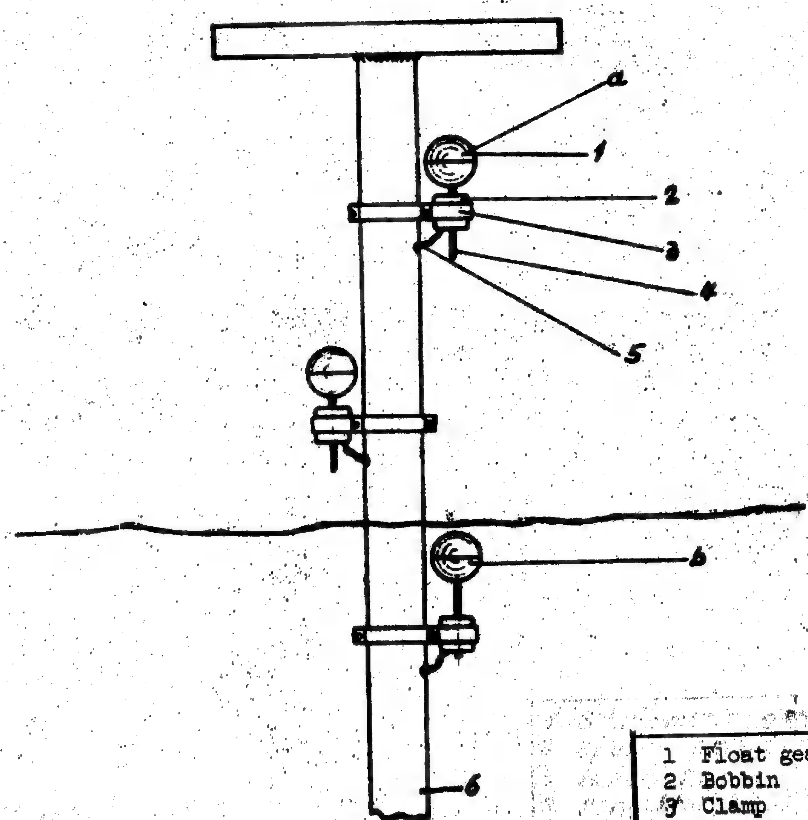
11. At gas withdrawal tests, the formation of steam depended largely upon the temperature, and the concentration. (Understandably more steam formed with lower temperatures, since K-Stoff rate of flow was appropriately greater.) Some examples:

B-Stoff 75%
K-Stoff 75
Temperature 350° C
Duration of burning - 100 seconds

Immediately, a steam mushroom developed behind the outlet nozzle. After combustion cut off, this steam mushroom had taken on the oblong shape of a white cloud of about 100 meters in length and 50 meters in diameter. The cloud withdrew upward and dissolved slowly after approximately ten minutes.

B-Stoff 75%
K-Stoff 75%
Temperature 1000° C
Duration of burning - 100 seconds

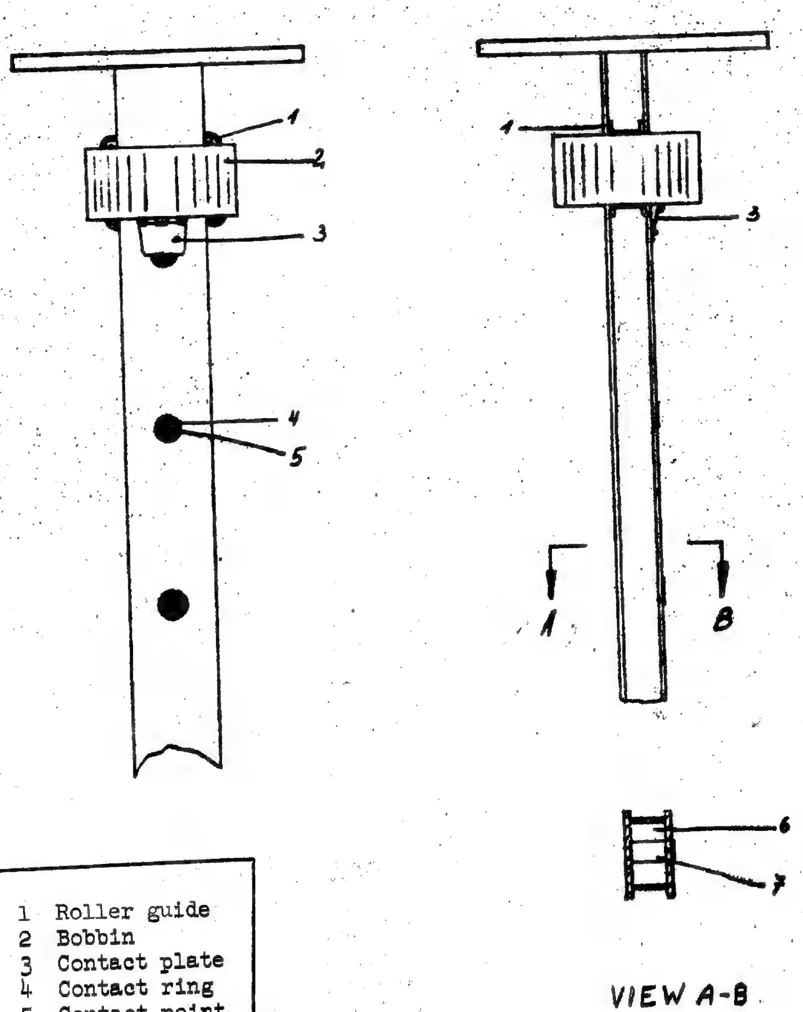
The gas flowing from the jet was seen as a bluish, glimmering, hardly-visible stream. At dusk, a dark red beam, about 30 cm. long, could be seen at the outlet opening. Steam formation started at six meters, seen from the jet nozzle, which, as already mentioned, did not take on as large proportions as at lower temperatures. With kerosene, kerosene test steamformation was considerably larger. The reason was that the combustion temperature of kerosene is much higher than that of B-Stoff, K-Stoff, respectively. Therefore, a greater rate of flow of kerosene as coolant is necessary, which, in turn, results in greater steam formation. The black steam mushroom was so large that the whole test field was darkened.



1 Float gear
2 Bobbin
3 Clamp
4 Contact pin
5 Cable
a At rest
b Contact position
c Pipe

(1ST FUEL PICK UP TRANSMITTER DEVELOPED)

25X1



1 Roller guide
2 Bobbin
3 Contact plate
4 Contact ring
5 Contact point
6 Cable channel
7 Spool

2ND FEELER SONDE DEVELOPED

(2ND FUEL PICKUP TRANSMITTER DEVELOPED)

[redacted] 25X1

Filling of the O_2, B-Stoff and K-Stoff Containers

1. The O_2 container is filled by putting pressure onto the transport wagon 7.35 to 10.29 PSI (0.5-0.7 atü)/see Sketches on pages 18 and 19/.

Filling Procedure - Open high pressure valve 43 (pressure for control valve box). Open overflow 74 and 75 via control board and control valve box. Open control choke 5, open exhaust valve 4. Open filler valve 8. Put pressure on the transport container via condenser coils. Filling takes about 12 - 15 minutes. After filling is finished, the open valves are closed and the transport container exhausted (entlueftet). Filling of containers 21, 22, and 23 is, in principle, the same.

2. B-Stoff Container

Filling Procedure - For an exact level indication, it is important to set the pressure reducer to about 73.5 PSI (5 atü). Open exhaust valve 34. Open filler valve 28. Air (belueftm) the propellant storage container in the intermediate depot with 7.35 - 11.76 PSI (0.5-0.8 atü). Filling takes about five minutes. After finishing filling procedure, reverse the described steps.

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Succession of the Combustion Tests

1. First test. [See sketch on page 55.] O_2 head [see sketch on page 40] with O_2 and B-Stoff preliminary stage; recorded with oscillograph: O_2 and B-preliminary stage (result of test - normal).

2. Two tests [see sketch on page 56]. O_2 head with B-Stoff head element [see sketches on pages 26 and 40]. O_2 - preliminary stage; B- preliminary stage; O_2 - main stage; B- main stage

Purpose of the Tests: Function test, judging of the flame distribution

Oscillograph: All four stages and a_A a_B

Result of Test: Satisfactory (slight burning of the cable in the combustion chamber.
The fire brigade extinguished it immediately)
P_o = tank pressures 117.6 - 132.3 PSI (8-9 atü)
E_A = A - Main stage injection pressure)
E_B = B - Main stage injection pressure) 80.85 PSI (5.5 atü)
A = O_2- rate of flow (Durchsatz)
B = B-Stoff rate of flow (Durchsatz)

3. Two tests [See sketch on page 56 (without Laval nozzles)] O_2 - head; B-head; short middle part; [see sketch on page 40].
Both preliminary and main stages were run again
Oscillograph: E_A and E_B, both the preliminary stages; a_A and a_B
Purpose of the tests: as in 2; (cooled off middle part to be closely examined for distortion, bumps and tears.
Result of Test: Unobjectionable
P_o = 117.6 PSI - 132.3 PSI (8-9 atü)
E_A = 80.85 PSI (5.5 atü)
E_B = 80.85 PSI (5.5 atü)
Water pump pressure = 88.2 PSI (6 atü)

4. Six tests: [see sketch on page 56] with "screwed on" nozzle O_2-head; B-head; short middle part; Laval nozzle (Lavalduese)
Narrowest cross section 40 . [see sketches on pages 40 and 56].

Preliminary and main stages were run
Oscillograph: a_A, a_B, E_A, E_B, P_i

Purpose of the tests:
- (a) testing of the above named parts at counter pressure, relative to combustion pressure P_i
- (b) different mixing proportions a_A and a_B
- (c) different tank pressurs P_o
- (d) different combustion pressures P_i

5. Six tests : Three middle parts were provided. With each middle part, two tests were run under the same condition, i.e., it was noted in which middle part best combustion resulted, and therefore which one was most effective.

(a) Long middle part 860 mm
(b) 3/4 " " 645 mm
(c) Short " " 430 mm

6. Two tests with short middle part (as in test 4)

P_o 323.4 PSI (22 atü) (tank pressure)

a_A } Proportion of mixture (not remembered by me)
a_B }

E_A 18
E_B 17.5
P_i 205.8 PSI (14 atü)

Pump pressure 88.2 PSI (6 atü)

7. Two tests with 3/4 length middle part (as in Test 6)

8. Two tests with long middle part (as in Test 6)

Result: Unobjectionable
It was shown that the result of the test varied only slightly with the use of three different middle parts, so that all further tests were run with the 3/4 middle part.

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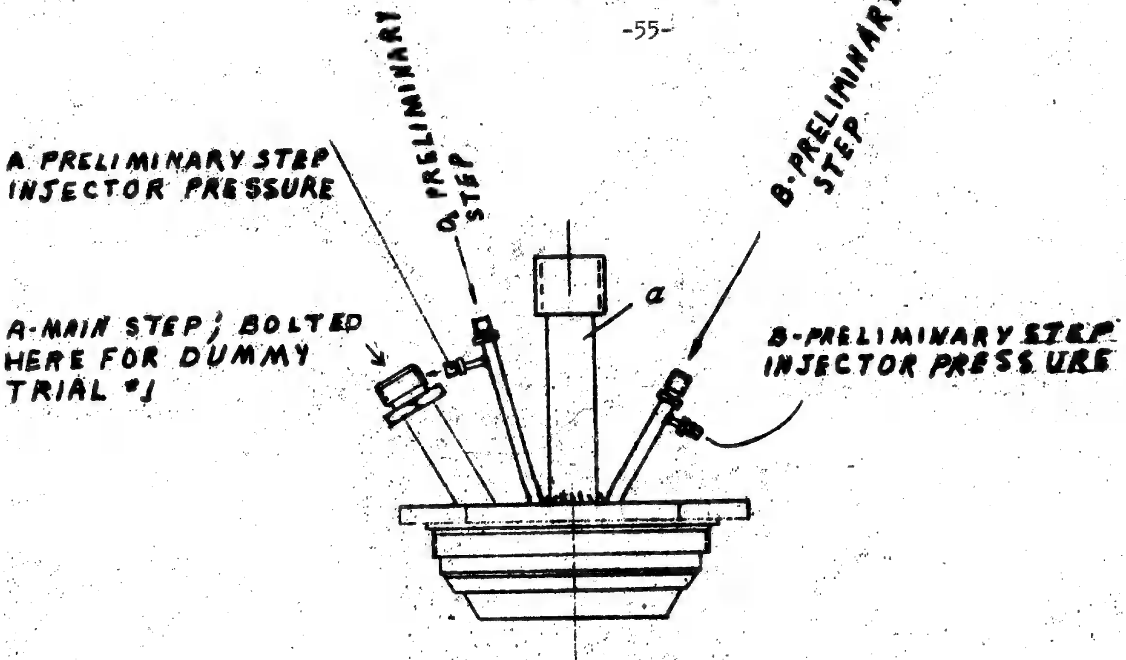

O_2 HEAD

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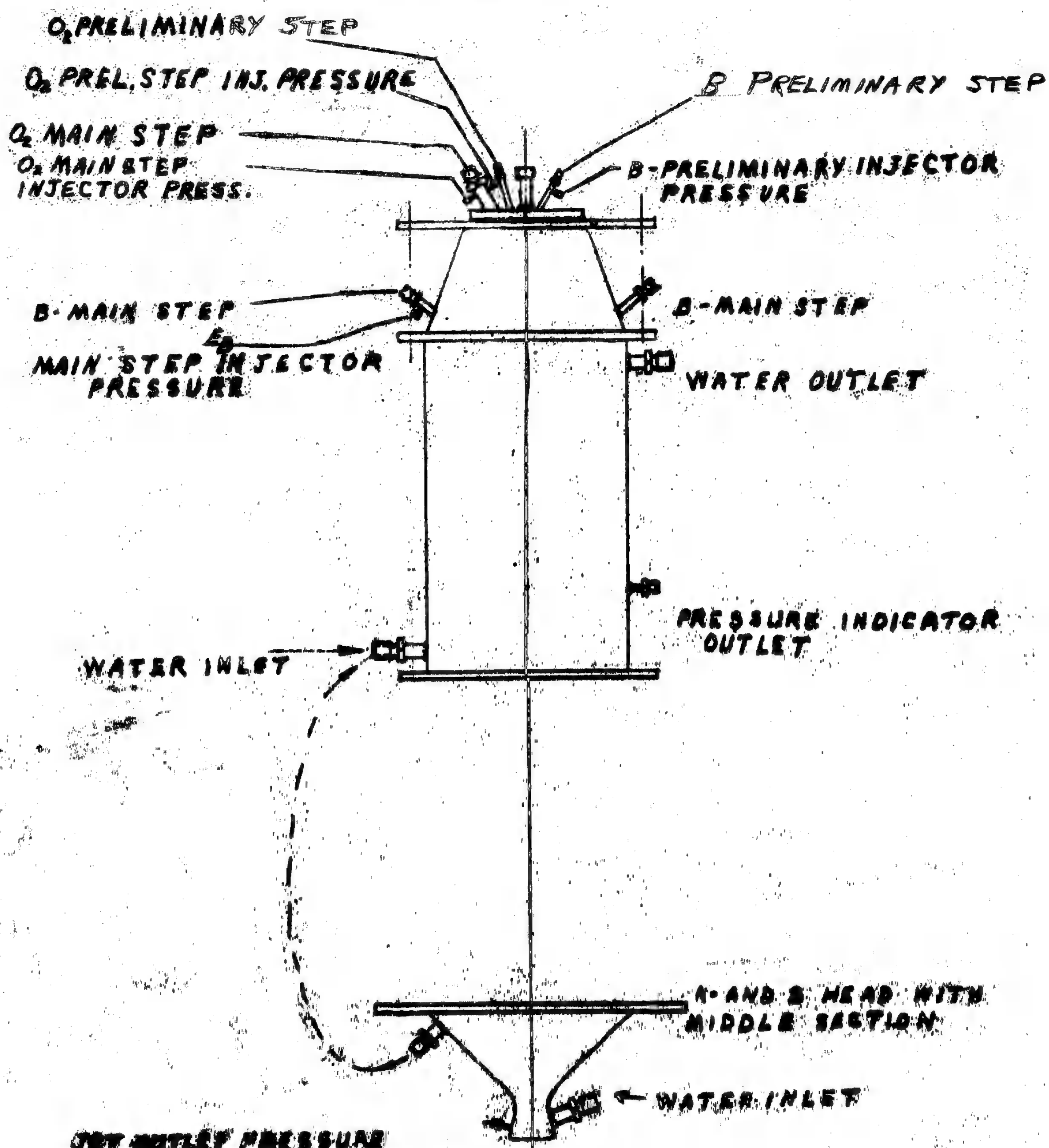

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Example of a Test Order. /See test order of the six tests, with screwed on jet./

TEST RECORD (or Log)

Test Campaign No...
Test Order No......

Consecutive No.	System:	Remarks:
	O_2 Head Drwg. No.... B^2 " " " Short Middle Pt. Drwg. No. Laval Jet Drwg. No.	

Test Characteristics:

Oscillograph Reading: a_A; a_B; E_A; E_B; P_1

P_e : 323.4 PSI(22 atü), Pump pressure: 88.2 PSI (6 atü)

Observed Values: (Not remembered by me)

Preliminary Setting - O_2 - Control Value: 1 1/2 turns

" " - B^2 " " 1 3/4 turns

Quantities to be tanked: O_2 - 100 kg. B-Stoff - 100 kg

Tanked Quantities, read before test: O_2, B-Stoff

Tanked Quantities, read after test: O_2, B-Stoff

Duration of Combustion: 80 sec.

Sequence of operation: (Schaltung)

O_2 Preliminary Stage; Firing; B- Preliminary Stage; O_2 Main Stage; B- Main Stage

Shutter Size for O_2 (Exact size is not remembered)

" " " B-Stoff (Exact size is not remembered)

Signatures:

Sector Leader (German)
Dr. UMPFENBACH

Sector Leader (Soviet)
Ing. MITSKEVICH

Test Researcher (German)
Dr. FERCHLAND

Proving Ground Leader (Soviet)
Ing. IOFFE

Test Stand Leader Mech. (German)
Ing. BRUENNER

Test Stand Leader Elect. (German)
Dr. MAGNUS

Test Evaluation (German)
Ing. PEHLE

All pressures of the above observed values were read at the manometers during the test, noted and later entered into this space of the test log.

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Parallelogram for Thrust Measuring [See sketch on page 59.]

1. Balance beam
2. Balance arm
3. Adjustable weight
4. Adjustable point
5. Pin
6. Bearing
7. Cutting edge with pan
8. Thrust measuring traverse (guard)
9. Coil with plug
10. Receiving basket
11. Inflexible carrier
12. Burner
13. Weights
14. Arm with plate
15. Pointer

Calibration - After all connections to the system were made, calibration began:

a. 8 gets a small initial pressure.
b. The pointers 15 are adjusted through 4; this position is fixed at zero by putting on certain calibration weights of 13 kilos. Calibration is made upward and back again. (Supposedly 10, 20, 60, 100, 20 - 150, 100, 60, 20, 10). The values of the individual calibration stages are read on the sensitive pressure gauge and noted in the calibration page. The calibration is fixed by turning on the oscillograph.

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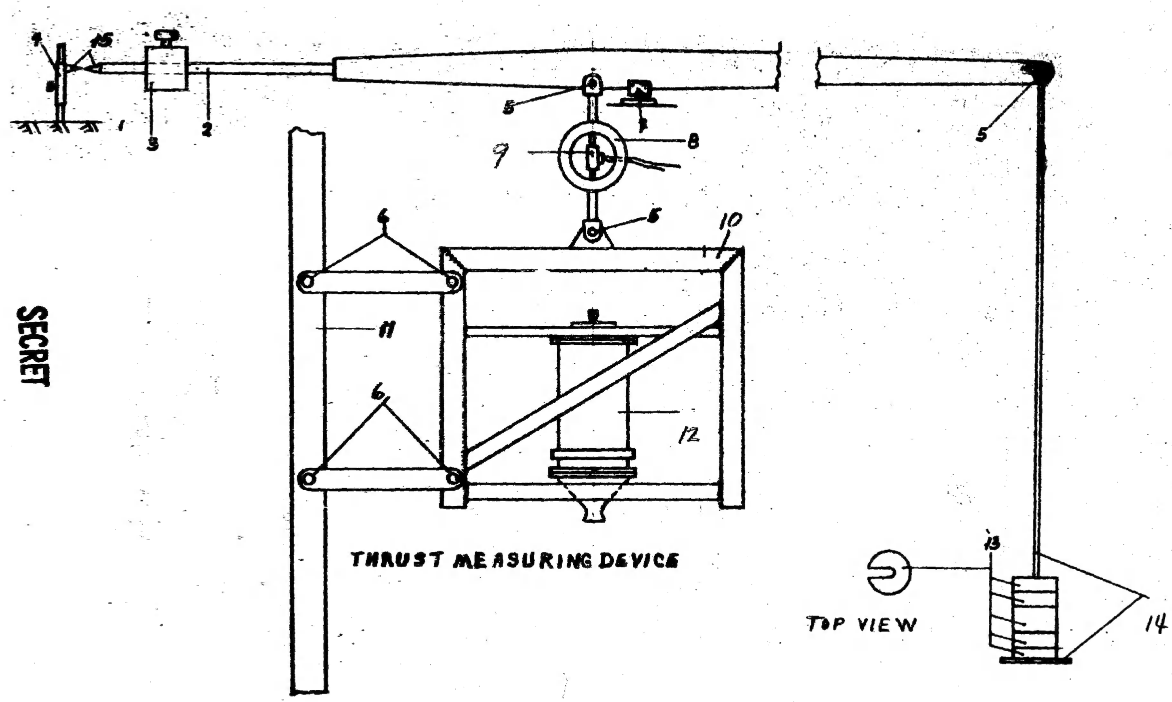

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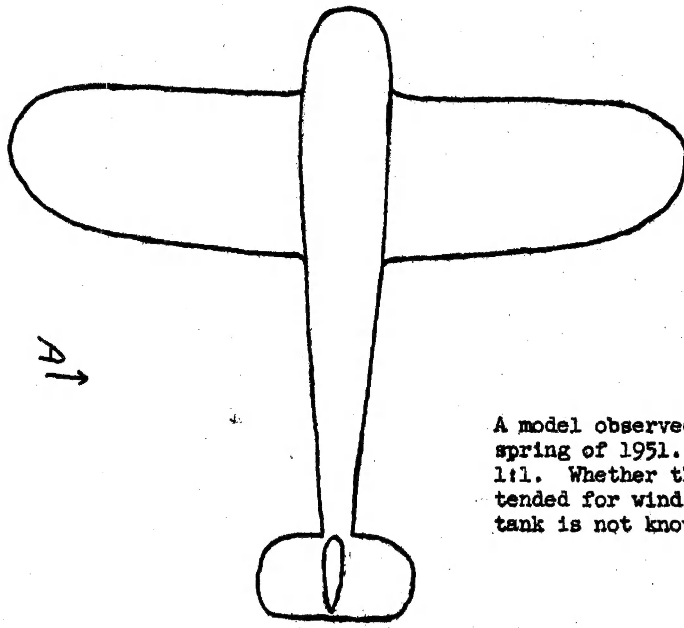
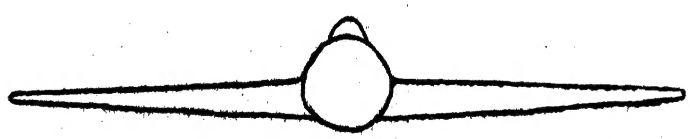
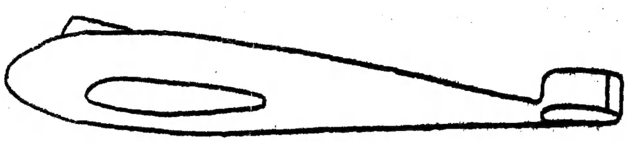


A

A model observed briefly in the spring of 1951. Approximate scale, 1:1. Whether this model was intended for wind tunnel or towing tank is not known.





VIEW A

1. [redacted] Comment. It will be noted that the letters "g", "h", and "i" do not appear in the sketch. They do appear, however, on page 13; pages 11 - 14 should be viewed together, as forming one diagram. 25X1

2. [redacted] Comment. In this instance a radiation destroyer is fixed into the ventilator, which, as its name indicates, destroys the beam of air. "Spreader of the beam" might perhaps be a more correct term than "safety valve." 25X1